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The North American Species of Whiteflies of the Genus Trialeurodes

By

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THE NORTH AMERICAN SPECIES OF WHITEFLIES OF THE GENUS TRIALEURODES[1]

By Louise M. Russell[2]

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INTRODUCTION

This publication treats the species of *Trialeurodes* known from North America. In this region the genus is of particular interest because of its wide distribution, the number and diversity of its food plants, and the injuriousness of certain species. It is the largest aleyrodid genus known on this continent, and all species now known in the Nearctic Region presumably are indigenous to it or are Neotropical species whose northern limits extend into that Region. Characteristics of interest are modifications in papillae and in the vasiform orifice exhibited by some of its members, and also the unusual parthenogenetic behavior of one of them.

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[1] Order Hemiptera, suborder Homoptera, family Aleyrodidae.

[2] The writer is greatly indebted to the following for the loan of valuable specimens used in this study: C. P. Alexander of Massachusetts Agricultural College, E. O. Essig of the University of California, G. F. Ferris of Stanford University, D. D. Penny of the California Spray-Chemical Company, E. S. Ross of the California Academy of Sciences, and W. W. Sampson of Berkeley, Calif. The following have given special assistance: C. F. W. Muesebeck, in charge of the Division of Insect Identification, Bureau of Entomology and Plant Quarantine, arranged for the loan of most of the material, and Sara Hoke DeBord, also of this Bureau, made the drawings; and W. R. Maxon, curator of the U. S. National Herbarium, granted the writer permission to examine plant material in that institution. Botanists of the Bureau of Plant Industry, Soils, and Agricultural Engineering identified a considerable amount of plant material and checked the botanical names of food plants. The writer expresses her sincere appreciation to these individuals for their kind cooperation, and to all others who have assisted in any manner.

The genus *Trialeurodes* occurs in Alaska, and is rather generally distributed in and below southern Canada. It is found on at least 65 plant families in that region. Judging from the material obtained by the writer in restricted collecting, it appears that extensive exploration would result in the discovery of new species as well as in a marked addition to our knowledge of the range and hosts of those already described.

The species of *Trialeurodes* that have claimed most attention as serious pests are *abutilonea*, *floridensis*, *packardi*, and *vaporariorum*. Each of these species is injurious to plants of recognized economic importance, and *vaporariorum* is especially harmful to numerous plants of agricultural or decorative value.

There has been little systematic work dealing with the genus *Trialeurodes*, and the descriptions of its members are scattered and incomplete, and few are accompanied by satisfactory illustrations. The recognition of species, therefore, has often been extremely difficult or impossible.

The purpose of this publication is to discuss and illustrate the Nearctic species of *Trialeurodes* in order to assist in their recognition, to indicate synonymy, to record the hosts and distribution of the insects examined, and to disseminate other information of interest or importance regarding the genus.

The work is based primarily on a morphological study of the fourth instar, the stage commonly known as the pupa case or pupa. This is the stage most often collected and described in the Aleyrodidae, and in the genus *Trialeurodes* it apparently possesses more satisfactory diagnostic characters, and a greater number of them, than any other stage. A comparable study of other stages was prohibited by the lack of instars definitely associated with the pupae in most of the species examined.

Instars other than the fourth were studied in species in which they were available. There were relatively few such species, however, and on this account it is difficult to appraise fully the usefulness of these instars in taxonomic work. They do not appear to have structures which permit the separation of closely related species, although they do possess morphological characters indicative of species groups. As far as representatives were available, the groups indicated in this paper on the basis of pupae were also distinguishable in some or all of the other stages. Group identity of a species usually can be determined more readily in the first-stage larvae than in the second or third stage, and it is sometimes more apparent in adult males than in adult females. The study of material in these stages for all species would probably aid in clarifying relationships within the genus.

During the study a structure was found for distinguishing male from female pupae. Previously a few workers have suggested that smaller specimens might be males, but no reliable character for separating the two was known. Since adults of the sexes are distinct, pupae were selected which contained well-developed imagoes. The insects were mounted either with the adults partially or entirely free from, but still associated with, their respective pupae. Pupae containing males have a small, membranous, bifid invagination situated medially between the posterior abdominal spiracles, whereas pupae enclosing females lack this organ. Female pupae in which adults are fully developed sometimes show three small spots, one of them medial between the posterior abdominal spiracles and one somewhat anterior to each of these spiracles, which may be produced by the genitalia, since they apparently are absent from recently emerged pupae. The bifid sac, on the other hand, is present when the pupae emerge from the third instar though it was not seen in any of the preceding instars. It is readily apparent when specimens are well prepared and in good position on a slide, but is usually indistinguishable under other conditions.

This organ is present in other aleyrodid genera, and its presence appears to be satisfactory for separating the sexes throughout the family.

Of the 39 specific names previously associated with or assigned to Nearctic members of *Trialeurodes*, 17 appear to be synonyms, and 1 represents a species belonging to another genus. Thirteen species are herein described as new, bringing to 34 the total number of Nearctic species of *Trialeurodes* known at the present time. Type specimens of 32 of the previously described species have been examined by the writer; the types not seen are presumed to be lost, or they are not present in North America. Unless otherwise stated, all type material of the new species described herein is deposited in the collection of the United States National Museum.

HOST ASSOCIATIONS

Most of the species of *Trialeurodes* treated here occur on a number of plant families, but a few are known from only a single genus. Descriptions of species occurring on only one genus are based on a relatively small number of specimens, and it is likely that eventually some of them will be discovered on additional hosts. Characteristics of leaves on which the insects are found range from succulent to coriaceous and from glabrous to pubescent. These properties appear to have an important bearing on the desirability of leaves as food plants and on the development of the insects. In this connection there are three interesting considerations, namely, host preference and selection, correlation between the structure of an insect and the leaf structure of the host, and the effect of the physical nature of a leaf on the morphology of an insect living upon it.

Other investigators have pointed out that certain species of the Aleyrodidae naturally select hosts suitable for their development, and that they avoid unsuitable plants even when such are readily available. It has been shown further that some insects apparently cannot live on certain types of leaves even though eggs are deposited on them or are transferred to them experimentally. Morrill (*13, p. 26*),[3] Latta (*8, p. 3*), Trehan (*22, p. 582*), and Lloyd (*9, p. 4*), have touched upon this subject. The writer's observations in the genus *Trialeurodes*, which were confined to the examination of a mass of museum material and to field observations, substantiate the findings of other workers. Suitability of leaf texture apparently is a primary factor in determining host preferences, but species differ greatly in their ability to live on different types of leaves. In the more adaptable species availability of hosts plays an important part in their selection. It appears to be nearly impossible for the less adaptive species to develop on unsuitable plants, however, regardless of their availability.

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[3] Italic numbers in parentheses refer to Literature Cited, p. 79.

In some aleyrodids there doubtless is a correlation between the structure of the insects and that of the leaves upon which they live. Takahashi (*19, pp. 1–2*) noted this while discussing a number of aleyrodids from the Oriental Region. Evidence of such correlation in *Trialeurodes* is based on differences in papillae and setae, for throughout the genus there is a tendency for insects living on smooth surfaces to lack prominent dorsal papillae and to have the submarginal papillae directed somewhat laterally. Conversely, the species normally inhabiting hairy leaves tend to have conspicuous dorsal papillae, and the submarginal ones directed diagonally or vertically. Certain members of the group normally living on hairy-leaved plants have some long setae, whereas other species occurring on smooth leaves have relatively short setae. There are exceptions to these general tendencies, however, especially among the species that live on both smooth and hairy leaves, but in the latter remarkable variations may occur.

The effect of the physical nature of leaves on the morphology of the insects living on them does not appear to have been studied for *Trialeurodes*, but the matter is of major importance in this group because of the variation in papillae and setae encountered in some of the species, and the ensuing question of the taxonomic value of these characters.

Authors have reported variation in setae in other aleyrodids. Husain and Trehan (*7, p. 705*) observed variation in their number in *Bemisia gossypiperda* Misra and Lamba, and Deshpande (*4, p. 126*) made a similar observation on *Aleyrodes lonicerae* Walker. Trehan (*22*) demonstrated a difference in number and size of the setae of *A. lonicerae* when this species developed on *Rubus* rather than on *Lonicera*, and noted a difference in their development in *Asterobemisia carpini* (Koch) when the latter was reared on blackberry (*Rubus*) rather than hornbeam (*Carpinus*).

The conspicuous differences in the size of setae, in the development of papillae, and in the size of the anal organ found in some species of *Trialeurodes* apparently are due largely to changes in the insect environment. The genus as a whole is a plastic one, but it is not uniformly so. Certain of the more stable species apparently cannot develop on diverse types of leaves, but the more plastic ones are able to do so though the appearance of such insects may be altered conspicuously by a change in hosts.

Although there apparently is no variation in the number of dorsal setae in the pupae or in the three preceding instars of any species, there sometimes is a striking diminution in the size of some setae when a species normally living on a hairy leaf surface develops on a smooth surface. So far as determinable, species normally living on smooth leaves seldom are capable of developing on extremely hairy ones. The variations in papillae are similar to those already noted for those species that develop only on hairy or on smooth leaves, respectively, and they appear to be attributable largely to the structure of the leaves on which the insects mature.

Although most members of this group customarily occur on the lower surface of leaves, certain species are found almost as frequently on the upper surface. In such cases no significant structural variation can be observed in the size of the orifice, the operculum, or the lingula. In some other species, however, found rather abundantly on the lower surface and sparingly on the upper surface, all parts of the anal organ are perceptibly larger in specimens from the upper surface of the leaves. The lack of uniformity in development of the anal organ may be attributable to the position of the infested leaf, the insect being able to cast the excrement away from the body without abnormal development of the organ in one case but not in the other. Such variation, however, may be partially controlled by the stability or the plasticity of the structure.

There usually is a difference in the body size of species which mature on both glabrous and pubescent surfaces, individuals from smooth leaves usually averaging larger than those from hairy leaves.

Doubtless there are other properties of plants which contribute to the diversification of the insects living upon them. The effect of the chemical content of the leaf is unknown, but it is evident that the physical characters of the leaves are intimately associated with insect development and morphology.

CHARACTERS OF VALUE

The pupae of *Trialeurodes* have a decided dearth of reliable differentiating morphological characters, and certain characters that are stable and useful in some species are variable and of limited value in others. So little information is available concerning the habits, biology, and genetics of most members of the genus, however, that it is necessary to rely upon structural characteristics almost entirely in devising a scheme of classification.

Characters that have proved most useful in differentiating species are the width of marginal crenulations, the number of segments distinguishable in the median area of the abdomen, the position of the ends of the transverse molting suture, the presence or absence of anterior marginal and first abdominal setae, the position of the eighth abdominal and usually the caudal setae, certain characteristics of the vasiform orifice, the number and position of disk pores, the sclerotization or membranousness of the derm, the presence or absence of tuberculate areas, the presence or absence of elongate setae and stout spines on the legs, and the distinctness of the anterior abdominal spiracles. Position and prominence of porettes are sometimes useful. Shape and size of papillae are good characters when these structures are well developed, but their value is diminished by the fact that the papillae are sometimes well developed and sometimes degenerate in the same species. The position of the papillae also is sometimes useful, but again it may vary exceedingly. The number of submarginal papillae is of value only when there is a great divergence in their number, or when a small difference is based on the study of numerous specimens. Only conspicuous differences in length of dorsal setae are useful; the marginal, cephalic, and first abdominal setae usually are reasonably constant in length, but the eighth abdominal and caudal ones may be either constant or exceedingly variable. Color appears to be helpful in some species but not in others. Species that are wholly or almost entirely black and those that are light in color usually show little variation in this characteristic; light brownish markings seldom are of consequence. Shape is rarely of value because of its uniformity throughout the genus, but it is of occasional assistance, as is also size, though the latter may vary greatly if the insects live on different types of leaves.

The presence or absence of abundant, white, somewhat flocculent material in unmounted specimens is helpful, and characteristics of the other waxy secretions are occasionally significant.

TERMINOLOGY

Many terms[4] employed in this publication are familiar to students of the Aleyrodidae. Although most terms are doubtless self-explanatory or readily interpretable, it may be desirable to define some of them briefly.

The **cephalic segment** is the anterior segment of the cephalothorax. **Disk pores** are the minute, circular, nonloculate pores of the dorsal surface and are designated as submarginal, subdorsal, and submedian, depending upon their position. **Porettes** are minute structures resembling and associated with the disk pores; they, as well as the papillae, are also designated according to their position. The **submarginal setal bases** are situated near the submarginal papillae; the **anterior marginal** and **posterior marginal setae** are located on the anterior and posterior margins of the body; **dorsal setae** are named from the body segments on which they occur, being called **cephalic, first abdominal,** and **eighth abdominal** (near vasiform orifice), except for those known as the **caudal** pair which are located at the posterior end of the body near the caudal furrow. The inverted T-shaped lines of the cephalothorax are known as the **median** and **transverse molting sutures.** The **pockets** are a pair of invaginations extending cephalad from the submedian part of the seventh abdominal suture. The **rim** of the vasiform orifice is the part usually rising vertically above the adjacent derm.

The **thoracic tracheal folds** are a pair of furrowlike depressions extending from the anterior thoracic spiracles to the body margin; the **abdominal tracheal fold** is the single median furrow which extends caudad from a depressed area adjoining the posterior abdominal spiracles to the body margin. **Tracheal pore areas** are points where the tracheal folds reach the body margin. **Adhesive sacs** are a pair of saclike extensions of the body wall mesad of the middle legs. The **ventral abdominal setae** are located somewhat anterior to the posterior abdominal spiracles. The **bifid sac** is the male organ.

Color refers to the pigment in the derm of the normal insect, not to body contents or to the color of parasitized specimens which often are brownish regardless of the color of the normal insect. **Length** and **width** are stated for the greatest length and width of the structure being measured. With respect to papillae, the length is the distance between the base and the tip, and the width is the diameter of the base.

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[4] The terms used herein and the structures to which they apply appear with a diagrammatic illustration of a trialeurodine pupa in the following paper by the writer which was issued while the present publication was in press: A Classification of the Whiteflies of the New Tribe Trialeurodini (Homoptera: Aleyrodidae), Rev. de Ent., 18, fasc. 1–2, pp. [1]–44, illus., 1947.

ILLUSTRATIONS

Magnifications for the drawings are uniform for all species and are as follows: Body outline (female pupa unless stated otherwise in legend), × 87.5; section of marginal, submarginal, and dorsal area, papillae, setae, and vasiform orifice, each × 345; inner basal area of leg, thoracic spiracles, area around abdominal spiracles, each × 650; bifid sac, × 1,500.

Outline drawings usually show only the dorsal surface, they usually do not show the submarginal setal bases or the porettes, and occasionally the color or sculpturing of the derm is not depicted. It should be recognized that some structures, particularly the papillae, appear quite different when viewed from different angles.

Genus TRIALEURODES Cockerell

Aleyrodes subgenus *Trialeurodes* Cockerell, 1902, Acad. Nat. Sci. Phila. Proc. 54: 283; Cockerell, 1902, Soc. Cient. "Antonio Alzate," Mem. 18: 206; Kirkaldy, 1907, Hawaii Bd. Commrs. Agr. and Forestry, Div. Ent. Bul. 2: 43–44; Quaintance, 1908, Homoptera, Fam. Aleyrodidae, *in* Wytsman, Genera Insectorum, fasc. 87, pp. 2, 4.

Genus *Trialeurodes* Cockerell, Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi; Baker and Moles, 1921, Rev. Chilena Hist. Nat. 25: 642–643; Laing, 1922, Ent. Monthly Mag. London 58: 255; *Trialeurodes* Quaintance and Baker, Bondar, 1928, Aleyrodideos do Brasil 2.a contribuicao, p. 32; *Trialeurodes* Laing, Takahashi, 1938, Nat. Hist. Soc. Formosa, Trans. 28: 269. (Genotype, *Aleurodes pergandei* Quaintance, by original designation.)

Aleyrodes subgenus *Asterochiton* Maskell, Kirkaldy (not as restricted by Cockerell, 1902), 1907, Hawaii Bd. Commrs. Agr. and Forestry, Div. Ent. Bul. 2: 43–44.

Genus *Asterochiton* Maskell, Quaintance and Baker (not as restricted by Cockerell, 1902), 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 104–105. (Pseudotype, *Aleyrodes vaporariorum* Westwood.)

Gymnaleurodes Sampson and Drews, 1940, Pan-Pacific Ent. 16: 29; Sampson, 1943, Ent. Amer. (n. s.) 23: 209. (Genotype, *Gymnaleurodes bellissima* Sampson and Drews, by original designation.)

Owing to errors and omissions in the literature the names *Asterochiton* and *Trialeurodes* have become greatly confused. A brief review of the circumstances responsible for the confusion seems desirable in order to show the reasons for the present concept and use of the two names. *Asterochiton* was established in 1879 by Maskell (*10, pp. 214–216*), who at the time believed it to be a coccid genus, and the new species *lecanioides* and *aureus* were included in it, the description of *lecanioides* preceding that of *aureus*. Maskell did not designate a type for his new genus, however, as Quaintance and Baker later stated. In 1890 Maskell (*11*) indicated that *Asterochiton* was an aleyrodid genus rather than a coccid one, but he did not include any species in it in this paper, although he described several species under *Aleurodes*, including *papillifer*, *simplex*, and *melicyti*. Herein he also stated that *Asterochiton lecanioides* "appears to have been made up of both *Aleurodes papillifer* and *A. simplex*," and that "*Ast. aureus* is *Aleurodes melicyti*." Maskell apparently considered that he had disposed of the names *Asterochiton*, *lecanioides*, and *aureus*, for he did not include any of them in his work of 1896 in which he listed the names *papillifer* and *melicyti* (*12, pp. 436, 438*). Cockerell (1902) apparently was the first to point out that the latter specific names were synonyms of *lecanioides* and *aureus*, respectively.

In 1902 Cockerell revived *Asterochiton* as a subgenus of *Aleyrodes* Latreille and designated *aureus* Maskell as its type. He also erected three other subgenera under *Aleyrodes*, and for the type of one of them, *Trialeurodes*, he selected *Aleurodes pergandei* Quaintance. Kirkaldy (1907) listed both of these segregates as subgenera but stated that the type of *Asterochiton* was "*lecanioides* Maskell (not *aurea* as Cockerell cites)." Both *Asterochiton* and *Trialeurodes* were listed as subgenera by Quaintance in 1908 and, though the authorship of *Asterochiton* was erroneously credited to Cockerell, its type was said to be *aureus* while that of *Trialeurodes* was given as *pergandei*. In their 1914 paper Quaintance and Baker omitted reference to that part of Cockerell's 1902 article dealing with *Asterochiton* and *Trialeurodes* and included under *Asterochiton*, which they restored to generic rank, the species Cockerell had already assigned to *Trialeurodes*. With respect to *Asterochiton* they also asserted that "Maskell erected this genus with his *lecanioides* as type * * * "; they synonymized *lecanioides* with *vaporariorum* Westwood, and indicated that the latter species, therefore, became the type of the genus. In the same paper they described the genus *Dialeurodoides* and designated *aureus* Maskell as its type. The following year these authors stated that they wished to make the following correction of the 1914 publication:

> *Asterochiton* Maskell was used for a series of species represented by *vaporariorum*, since the first species described under this genus by Maskell proved to be this insect under the name of *papillifer*. We had overlooked the fact that Professor Cockerell had designated *aureus* as the type of *Asterochiton* * * * and had proposed a subgeneric name, *Trialeurodes*, with *pergandei* as type, a species of the *vaporariorum* series. *Asterochiton* of our paper must, therefore, replace *Dialeurodoides*, and *Trialeurodes* Cockerell, *Asterochiton*.

In this instance *lecanioides* should have been used instead of *papillifer*, since *lecanioides*, which antedated *papillifer*, was the name actually included by Maskell under *Asterochiton*. Their emendation apparently escaped the attention of many entomologists, though Laing called attention to it in 1922, for from 1914 to 1940 various workers assigned species of *Trialeurodes* to *Asterochiton*, or indicated in some way that they did not understand the use of the two names. The assignment of *Trialeurodes* to Quaintance and Baker by Bondar, and to Laing by Takahashi, were of course erroneous.

Since Cockerell's designation of the genotypes of *Asterochiton* and *Trialeurodes* antedates the designations of Kirkaldy, and Quaintance and Baker, and since it complies with the International Rules of Zoological Nomenclature, it is to be accepted. Consequently, the species congeneric with *aureus* belong to *Asterochiton*, and those congeneric with *pergandei* should be assigned to *Trialeurodes*.

Study of a paratype specimen of *Gymnaleurodes bellissima* Sampson and Drews, and other insects assignable to that species, convinced the writer that *Gymnaleurodes* must be suppressed as a synonym of *Trialeurodes*. This synonymy was indicated by Sampson in 1943.

Trialeurodes is more closely related to *Aleuroparadoxus* and to *Aleurotithius* of Quaintance and Baker than to other established genera. It can be separated from these genera, however, by the following combination of characters:

Median length of seventh abdominal segment no more than about one-third median length of sixth abdominal segment, eighth abdominal setae not anterior to cephalic margin of vasiform orifice, vasiform orifice cordate or subcordate, operculum occupying at least half of the orifice and its posterior margin usually curved, dorsal papillae usually not modified into large, flat, irregular areas, body margin without strong teeth, usually without tracheal pores, tracheal folds without characteristic markings, anterior abdominal spiracles conspicuously smaller than the thoracic ones or not apparent.

Generic Description.—Living on both surfaces of leaves, but most abundant on the lower surface. Nearly flat dorsally, young pupae thin, the older ones usually relatively thick owing to a swelling of the ventral part of the body which elevates the dorsum of the insect from the leaf; the swollen ventral portion encircled by a band of thin, translucent, whitish (transparent opposite tracheal folds in living insects) wax which extends from just beneath the body margin to the leaf in a vertical palisade; a very thin layer of transparent wax covering dorsal and ventral surfaces of the body. Glassy, waxy rods apparently emanating from disk pores, supported on papillae and directed similarly to them. Derm colorless, yellowish, brownish, or black, membranous or sclerotized. Elliptical or subelliptical in outline, 0.50–1.35 mm. long and 0.35–1 wide.

Crenulations of body margin distinct but rather weak, not toothlike; submarginal ridges very weak to moderately strong, apparent near crenulations in any case; tracheal pores absent. Submarginal disk pores and porettes present, usually in a well defined row. Submarginal papillae either well or poorly developed. Submarginal setal bases in 13 or 15 pairs, arranged in a single row.

A pair of setae on the eighth abdominal segment opposite the vasiform orifice, a median caudal pair, and a posterior lateral pair situated just beneath the body margin. Dorsal disk pores [5] and porettes present. Submargin not or only slightly deflexed, distinct from dorsal disk, eyespots and rachis absent. Transverse molting suture just anterior to thoracoabdominal one. Segmentation fairly distinct in median and submedian area of dorsum; cephalo-thoracic suture usually indicated by a very faint line or depression, promesothoracic more distinct and with a median rearward bend, mesometathoracic distinct and nearly straight. Seven or eight segments apparent in median area of abdomen but 8 apparent subdorsally, the thoracoabdominal and anterior 5 abdominal sutures usually terminating at, the posterior 2 usually defined through, subdorsum. First abdominal suture straight, ends of second bent cephalad almost to first suture, third slightly curved but its ends practically opposite its center, fourth and fifth slightly curved with their ends somewhat posterior to their midpoints, sixth strongly reflexed from inner subdorsum; seventh strongly reflexed from submedian area and either posterior to or underneath sixth suture in median area. Median length of cephalic segment greater, and that of prothorax less, than combined lengths of subequal mesothorax and metathorax; median length of first abdominal segment greater than that of second and about the same as the subequal third, fourth, fifth, and sixth; seventh usually no more than one-third length of sixth; eighth much longer than any other segment. A pair of submedian pockets extending cephalad from posterior suture. A pair of submedian depressions usually present on mesothoracic and metathoracic segments and on all abdominal ones except the eighth. Vasiform orifice cordate or subcordate, ending abruptly, usually situated approximately its width from the posterior abdominal suture and at least its length from the posterior body margin, its rim usually rising above the body derm laterally, and its sides rather broadly ridged, its bottom extending forward one-half to two-thirds the length of the orifice. Operculum cordate or subcordate and filling at least half of the orifice, covered ventrally and on its posterior margin with minute slender spines, the ventral ones arranged in a definite pattern following the contour of the organ; also with a pair of small setae ventrally. Lingula elongate, contained in orifice, usually with 3 pairs of lateral lobes and an unpaired terminal one; covered with minute slender spines, but a minute median channel evident between them dorsally on terminal lobe; also a pair of small setae at the base of the third pair of lateral lobes and a long pair arising ventrally at the base of the terminal lobe. Caudal furrow without characteristic markings at inner end.

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[5] Occasionally what appears to be a minute pencil of wax emanates from these structures. The wax apparently has been mistaken for setae by some authors.

Marginal wax tubes apparent ventrally, inconspicuous except at tracheal pore areas. Tracheal folds usually apparent, without characteristic markings. A slightly sclerotized, oblong, platelike area surrounding the opening of each thoracic spiracle; atrium of spiracle somewhat thimble-shaped; outer side of atrium, or outer side of sclerotized area around opening, or both, with at least a few minute spines. Posterior abdominal spiracles larger than thoracic ones, as far caudad as the posterior part of the vasiform orifice, lacking sclerotized plate and minute spines. Beak indistinctly segmented, apparently having 2 pairs of very short, stout setae at tip. Antenna apparently 1-segmented though with a suggestion of division near the base, extending just beyond anterior spiracle; distal end produced into a finger-shaped process, bearing numerous minute spines and apparently 3 very small sensory setae. Leg stout; 3 segments suggested; 1 minute and 2 or 3 very minute setae, or bases, near distal end of leg; about 4–6 minute setae, or bases, around basal part of anterior and posterior legs and 6–8 around middle leg. A submedian pair of adhesive sacs[6] apparently on mesothorax, with a few very minute spines. Ventral abdominal setae situated approximately their length anterior to posterior abdominal spiracles. Bifid sac present in males, absent in females.

KEY TO SPECIES OF TRIALEURODES

1. Marginal crenulations relatively broad, no more than 18 and usually fewer than 13 in 100 μ; anterior marginal setae present; apparently 15 pairs of submarginal setal bases;[7] anterior abdominal spiracles small but usually readily apparent, if not so, then anterior legs without spines and middle and posterior legs each with 2 large and 2–4 small spines and a slender seta at least 5 μ long and perceptibly longer than the minute setae---------- 2

Marginal crenulations relatively narrow, as few as 20 but usually at least 24 in 100 μ; anterior marginal setae present or absent; apparently 13 pairs of submarginal setal bases; anterior abdominal spiracles usually not apparent, but if so, then anterior legs with 1 spine and middle and posterior legs each with fewer than 4 spines; slender setae as above, or absent------------------ 24

2. Vasiform orifice subcordate, usually practically as wide as long, except in *mirissimus*, located at least twice its length from body margin, its rim defined across anterior end; operculum subcordate, filling at least seven-tenths of the orifice and completely covering the lingula, or covering all but the posterior margin of its terminal lobe; submarginal papillae in a single, close-set row, their tips directed laterally, characteristic in shape and elongate in ventral view, their inner ends somewhat convex and outer ends pointed; submarginal disk pores in upper part of basal portion of papillae; dorsal papillae absent; transverse molting suture rather strongly curved, its ends opposite a point slightly anterior to midpoint of mesometathoracic suture; bases of caudal setae situated anterior to papillae, the setae relatively short, less than 25 μ long and usually not extending beyond body margin; large spines absent from legs. Layer of wax on dorsum very tough and adhering to derm. Species apparently confined to relatively smooth leaves (Floridensis Group, p. 18.)- 3

Combination of characters different from above------------------ 10

3. Median section of seventh abdominal suture as far cephalad as sixth suture so that only 7 segments are visible in median area of abdomen; subdorsal tubercles present and some immediately posterior to cephalic setae, median abdominal ones absent---- 4

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[6] Morrill (*14, p. 29*) stated that these structures are "probably adhesive in function, serving to keep the insect attached to the leaf during the process of ecdysis."

[7] The total number of submarginal setal bases is often difficult to ascertain in the pupae, but it apparently is the same in this instar as in those preceding it, and the setae are well defined in the first instar. It is helpful, therefore, to examine the first stage as well as the pupae.

Median section of seventh abdominal suture posterior to sixth suture so that 8 segments are visible in median area of abdomen; subdorsal tubercles present or absent but none immediately posterior to cephalic setae, median abdominal ones present or absent … 5

4. Dorsal disk pores fairly numerous, not distributed across dorsum to submargin, usually only 2 submedian pairs on each of abdominal segments 1 and 3–7 and no submedian ones on abdominal segments 2 and 8; usually 3 or 4 subdorsal pairs on each of abdominal segments 3–7; operculum unusually long, actually longer than wide, its posterior part rather strongly narrowed, extending beyond lingula
mirissimus Sampson and Drews, p. 27.

Dorsal disk pores very numerous, distributed across dorsum to submargin, usually 4 or 5 submedian pairs on each of abdominal segments 1 and 3–7 and 2 or 3 submedian pairs on each of abdominal segments 2 and 8, 5–9 (usually 8) subdorsal pairs on each of abdominal segments 3–7; operculum not so long, as wide as long, its posterior part slightly broader, extending to tip of lingula … *oblongifoliae*, new species, p. 26.

5. (3) Mounted insects 0.75–0.90 mm. long and 0.50–0.65 wide; marginal crenulations somewhat variable in width, around 16 in 100 μ; submarginal papillae broad (for Floridensis Group) in relation to their length, 14–16 μ long and 8–10 wide; subdorsal tubercles present on majority of body segments and a median one on each of first and second abdominal segments
floridensis (Quaintance), p. 19.

Mounted insects measuring upwards of 0.90 mm. long and 0.60 wide; marginal crenulations nearly uniform in width, usually 10–12 in 100 μ; submarginal papillae narrower in relation to their length, 18–28 μ long and 8–12 wide; subdorsal tubercles present or absent, but if present median ones absent or more numerous than in *floridensis* … 6

6. Submedian disk pores absent from eighth abdominal segment; usually 2–5 pairs of dorsal disk pores on each of abdominal segments 3–7; dorsal tubercles numerous except in *intermedia* … 7

Submedian disk pores present on eighth abdominal segment; usually more than 5 pairs of dorsal disk pores on each of abdominal segments 3–7; dorsal tubercles absent or sparse … 9

7. Dorsal tubercles absent; usually a total of 4 (occasionally 3) pairs of dorsal disk pores on each of abdominal segments 4–6
intermedia, new species, p. 20.

Dorsal tubercles present; usually a total of 2 (occasionally 3) or 5 pairs of dorsal disk pores on each of abdominal segments 4–6 … 8

8. Without a prothoracic pair of subdorsal tubercles conspicuously larger than other subdorsal ones, a median tubercle on each of anterior 5 or 6 abdominal segments; usually 1 pair of submedian disk pores and a total of 2 or 3 pairs (submedian plus subdorsal) on each of abdominal segments 4–6; submarginal papillae 20–24 μ long and 8–10 wide … *vitrinellus* Cockerell, p. 22.

With a prothoracic pair of subdorsal tubercles conspicuously larger than other subdorsal ones, median abdominal ones absent; usually 2 pairs of submedian disk pores and a total of 5 pairs (submedian plus subdorsal) on each of abdominal segments 4–6; submarginal papillae 20–24 μ long and 10–12 wide
coccolobae, new species, p. 23.

9. (6) Dorsal disk pores fairly numerous, fewer than 11 pairs on each abdominal segment; submedian disk pores of eighth abdominal segment situated anterior to orifice; no conspicuous swollen areas posterior to pockets; each tracheal pore area marked by the narrowness of 4–8 marginal crenulations; vasiform orifice moderately sclerotized, its sides vertically ridged and its bottom smooth or nearly so; without a dark subdorsal band
bellissima (Sampson and Drews), p. 24.

Dorsal disk pores exceptionally numerous, more than 11 pairs on majority of abdominal segments; submedian disk pores of eighth abdominal segment situated anterior to eighth abdominal setae; a pair of conspicuous swollen areas posterior to pockets; tracheal pore areas not indicated; vasiform orifice strongly sclerotized, its sides vertically ridged near top but netted by fine grooves elsewhere; usually with a dark subdorsal band---------- *multipori*, new species, p. 25.

10. (2) Median section of seventh abdominal suture as far cephalad as sixth suture so that only 7 segments are visible in median area of abdomen; ends of transverse molting suture about opposite its center; papillae well developed or indicated only by a differentiated area in derm, but broadly conical if well developed, submarginal ones totaling 34–72; submedian disk pores usually absent from sixth abdominal segment, majority of submarginal disk pores distad of submarginal papillae, except in *tephrosiae;* approximately 14 marginal crenulations in 100 μ; 2 relatively large and 2–4 smaller spines on each middle and posterior leg; derm rather thin and membranous; insects unusually small, 0.50–0.75 mm. long and 0.35–0.50 wide (Variabilis Group, p. 28.)---------- 11

Combination of characters different from above---------- 13

11. Rim absent from anterior end of vasiform orifice; cephalic setae only about one-fifth length of eighth abdominal setae; distance between anterior margin of vasiform orifice and posterior suture practically equal to width of orifice; width of operculum about one-third greater than its length, posterior margin of operculum rather broadly curved and usually reaching only to third pair of lobes of lingula; majority of submarginal papillae and some dorsal ones usually well developed; ventral abdominal setae about 32 μ long---------- *tephrosiae*, new species, p. 32.

Rim present across anterior end of vasiform orifice; cephalic setae usually about as long as eighth abdominal setae; distance between anterior margin of vasiform orifice and posterior abdominal suture as in *tephrosiae*, or equal to about three-fourths the width of the orifice; width of operculum about one-tenth greater than its length, posterior margin of operculum less broadly curved and usually reaching at least to terminal lobe of lingula; papillae well developed or degenerate; ventral abdominal setae about 20 μ long---------- 12

12. Cephalic, first abdominal, and eighth abdominal setae usually relatively short, only 8–16 μ, bases of the eighth abdominal pair posterior to anterior margin of operculum, opposite widest part of orifice; usually 1 pair (rarely 2 pores on one half of body) of submedian disk pores on first abdominal segment; posterior pair of submarginal papillae about in line with penultimate pair; some or all submarginal papillae usually undeveloped and dorsal ones rarely developed; thoracic tracheal pore areas often indistinguishable---------- *variabilis* (Quaintance), p. 29.

Cephalic, first abdominal, and eighth abdominal setae usually relatively long, 75–100 μ, bases of the eighth abdominal pair opposite anterior margin of operculum, anterior to widest part of orifice; usually 2 pairs (occasionally 1 pore on one half of body) of submedian disk pores on first abdominal segment; posterior pair of submarginal papillae somewhat anterior to penultimate pair; majority of submarginal papillae and some dorsal ones well developed; each thoracic tracheal pore area usually defined by narrowness and depth of 3 or 4 marginal crenulations *similis*, new species, p. 31.

13. (10) Dorsal derm brown or black, except in *tentaculatus*, thick and heavily sclerotized; ventral derm slightly lighter in color, slightly thinner, and somewhat less sclerotized than dorsal derm; dorsal papillae usually absent but if present not conical; caudal setae relatively short, either not attaining, or reaching only slightly beyond, body margin; submarginal papillae varying in shape, but if somewhat conical the submarginal disk pores are mesad

of or are in bases of papillae, except in *bemisae* and *tentaculatus;* papillae usually pointing laterally or a few diagonally, the lower part of their outer extremities much more heavily sclerotized than the upper part; thoracic tracheal pore areas usually not apparent, but if distinguishable without pore-shaped designs on submarginal ridges; 8–10 marginal crenulations in 100 μ except in *tentaculatus* in which there are 18 (Hutchingsi Group, p. 33.) -- 14

Dorsal derm usually very pale yellow or colorless, thin and membranous; ventral derm colorless, very thin and membranous; dorsal papillae somewhat conical if present; caudal setae relatively long, extending far beyond body margin except in certain specimens of *vaporariorum;* submarginal papillae rather broadly conical with fairly acute tips which point laterally, diagonally, or vertically, but the lower part of their outer extremities not conspicuously more heavily sclerotized than the upper part; majority of submarginal disk pores distad of submarginal papillae; thoracic tracheal pore areas sometimes clearly marked by pore-shaped designs on submarginal ridges; rarely as few as 9 but usually 12 marginal crenulations in 100 μ (Vaporariorum Group, p. 42.) -- 19

14. Papillae somewhat crescent-shaped or knoblike, their distal portion broadly curved, a submarginal row not clearly differentiated from dorsal ones but all tending toward segmental arrangement with the inner ones smaller than the outer ones; first abdominal setae absent; bases of caudal setae at the body margin; caudal furrow broad, extending only to the inner papillae. Unmounted specimens covered with an abundant, white, somewhat fibrous secretion -- *merlini* (Bemis), p. 41.

Papillae not shaped as above, and a submarginal row distinct, dorsal ones absent or differing from above in shape, size, number, and arrangement; first abdominal setae present except in *tentaculatus;* bases of caudal setae farther from the body margin; caudal furrow relatively narrow and extending at least to the submarginal papillae. Unmounted specimens without an abundant, white, somewhat fibrous secretion except in *corollis* -- 15

15. Submarginal disk pores not distad of submarginal papillae; row of submarginal papillae continued across posterior end of body; submarginal papillae totaling upward from 150; dorsum dark brown or black -- 16

At least half of submarginal disk pores distad of submarginal papillae; row of submarginal papillae interrupted at posterior end of body; submarginal papillae totaling downward from 150; dorsum lighter brown or pale yellow -- 17

16. Submarginal papillae in a double to triple row, tips of outer ones around the length of a papilla from body margin, totaling 220–345; submarginal disk pores contiguous to or in bases of submarginal papillae; cephalic setae around 24 μ long, both first and eighth abdominal setae around 28 μ long; subdorsal disk pores absent from abdomen -- *hutchingsi* (Bemis), p. 34.

Submarginal papillae in a single row, their tips around the width of a papilla from body margin, totaling 153–206; majority of submarginal disk pores slightly removed from submarginal papillae; cephalic setae around 12 μ long, both first and eighth abdominal setae around 12–16 μ long; subdorsal disk pores present on abdominal segments 3–7 -- *madroni* (Bemis), p. 35.

17. (15) Submarginal papillae elongate, their tips drawn out, acute, and about twice the length of a papilla from body margin, the papillae 24–30 μ long and 12–16 wide; submarginal disk pores approximately in line with distal ends of submarginal papillae; dorsal papillae greatly modified, irregular in outline, nearly flat, and the tops membranous, arranged in 6 subdorsal groups; eighth abdominal segment without dorsal disk pores -- *corollis* (Penny), p. 36.

Submarginal papillae not shaped as in *corollis*, their tips not drawn out, rather blunt, and around the length of a papilla from body margin, much wider in proportion to their length than above; submarginal disk pores mesad or farther distad of tips of submarginal papillae than in *corollis* except in *bemisae*; dorsal papillae absent; eighth abdominal segment with dorsal disk pores ---------- 18

18. About 18 marginal crenulations in 100 μ; approximately half of submarginal disk pores mesad of submarginal papillae, the remainder distad of them and the majority closer to body margin than to papillae; vasiform orifice usually brownish and darker than rest of body, which is yellowish; first abdominal setae absent; submedian disk pores present on second abdominal segment ---------- *tentaculatus* (Bemis), p. 39.

About 10 marginal crenulations in 100 μ; majority of submarginal disk pores distad of and close to submarginal papillae; vasiform orifice brown but no darker than rest of body, which is brown; first abdominal setae present; submedian disk pores absent from second abdominal segment --- *bemisae*, new species, p. 38.

19. (13) Operculum completely covering lingula, its length at least three-fourths the length of the vasiform orifice; top of orifice slightly smaller than upper part of the cavity itself, and its rim poorly differentiated from adjacent body derm; grooves beside orifice and caudal furrow indistinct; submedian disk pores usually absent from one or another of abdominal segments 3–6 and usually only 1 pair of subdorsal disk pores on each of abdominal segments 3 and 4; mounted insects 0.50–0.70 mm. long and 0.35–0.50 wide. Unmounted insects with vertical palisade of wax conspicuously higher at anterior end of body than at posterior end ---------- *diminutis* (Penny), p. 54.

Operculum not reaching beyond third pair of lobes of lingula, its length no more than two-thirds the length of the vasiform orifice; top of orifice at least as large as upper part of the cavity itself, and its rim well differentiated from adjacent body derm; grooves beside orifice and caudal furrow well defined; submedian disk pores usually present on each of abdominal segments 3–6 and usually 2 or more pairs of subdorsal disk pores on abdominal segment 3 and sometimes on 4; mounted insects sometimes as small as 0.65 mm. long and 0.40 wide but usually more than 0.70 mm. long and 0.50 wide. Unmounted insects with vertical palisade of wax practically uniform in height ---------- 20

20. First abdominal setae absent ---------- 21

First abdominal setae present ---------- 22

21. Posterior pair of submarginal papillae anterior to caudal setae and penultimate pair of submarginal papillae, conspicuously larger than majority of submarginal papillae if well developed, and usually fairly well developed even if others are degenerate; submarginal papillae totaling 42–72; each thoracic tracheal pore area usually marked by a pore-shaped design on submarginal ridges; a median tuberculate area on each of first and second abdominal segments ---------- *notata*, new species, p. 55.

Posterior pair of submarginal papillae in line with caudal setae and penultimate pair of submarginal papillae, no larger than many other submarginal papillae, all submarginal ones usually well developed; submarginal papillae totaling 68–136; each thoracic tracheal pore area inevident or weakly marked by a few striations on 2 submarginal ridges; no median tuberculate area on first or second abdominal segment ---- *drewsi* Sampson, p. 52.

22. (20) Dorsum with a conspicuous, lightly sclerotized, subdorsal ridge on which are located subdorsal disk pores and papillae; a median tuberculate area on each of first and second abdominal segments; tracheal pore areas unusually conspicuous; majority of submarginal disk pores closer to body margin than to submarginal papillae, the latter rather far from body margin, most of them being about three times the width of a papilla from it, the majority of them pointing vertically, arranged in a single

irregular row of 58–78; submarginal setal bases in line with or distad of submarginal papillae
varia Quaintance and Baker, p. 49.

Dorsum without a subdorsal ridge; no median tuberculate area on first or second abdominal segment; thoracic tracheal pore areas moderately conspicuous or inevident; majority of submarginal disk pores closer to submarginal papillae than to body margin; submarginal papillae nearer body margin, usually no more than twice the width of a papilla from it, pointing laterally, diagonally, or vertically, arranged in a fairly regular single row or in an irregularly single, crowded row to an irregularly triple one, often more numerous than in *varia;* majority of submarginal setal bases mesad of submarginal papillae---- 23

23. Subdorsal disk pores rather numerous, usually 3 or 4 pairs on each of abdominal segments 3 and 4 and at least 2 pairs on each of posterior 4 segments; papillae usually well developed near majority of subdorsal pores; submarginal papillae in an irregularly single, crowded row to an irregularly triple one, totaling 115–175; both submarginal and dorsal papillae rather narrowly conical, majority of them around 14 μ long and 12 wide; posterior pair of submarginal setal bases with setae 5–8 μ long; each thoracic tracheal pore area obscure or poorly marked by weak indentations in 2 or 3 marginal crenulations
glacialis (Bemis), p. 51.

Subdorsal disk pores less numerous, usually only 2 pairs on each of abdominal segments 3 and 4 and only 1 pair on each of posterior 4 segments; papillae either not well developed near any subdorsal pores or as many as 10 pairs well developed, but usually no more than 10 and usually only 1 pair on a segment, usually 1 pair either poorly or well developed on each of cephalic, mesothoracic, third and fourth abdominal segments; both submarginal and dorsal papillae rather broadly conical when well developed, average submarginal ones 8–12 μ long and 12–16 wide; posterior pair of submarginal setal bases with setae about 4 μ long; each thoracic tracheal pore area marked by a pore-shaped design on submarginal ridges and by narrowness of 4 or 5 marginal crenulations
vaporariorum (Westwood), p. 43.

24. (1) Median section of seventh abdominal suture posterior to sixth suture so that 8 segments are visible in median area of abdomen; 2 pairs of submedian disk pores on first abdominal segment; eighth abdominal setae situated just posterior to widest part of vasiform orifice and closer to it than to seventh abdominal suture, the setae shorter than width of orifice; anterior marginal setae present; each leg with at least 1 well-defined spine and middle and posterior legs each with a slender seta at least 5 μ long and appreciably longer than minute setae (Pergandei Group, p. 56.)-- 25

Median section of seventh abdominal suture as far cephalad as sixth suture so that only 7 segments are visible in median area of abdomen; usually 1 pair of submedian disk pores on first abdominal segment; eighth abdominal setae situated opposite or anterior to widest part of vasiform orifice and at least as close to seventh abdominal suture as to orifice, the setae longer or shorter than width of orifice; anterior marginal setae absent; legs without spines and slender setae 5 μ long and appreciably longer than very minute setae (Abutilonea Group, p. 70.)---- 31

25. Dorsal disk pores unusually numerous, the majority of them in unique arrangement, being in 12 scallops of which 3 are on each half of the cephalothorax and 3 on each half of the abdomen, outer ends of scallops located in outer subdorsum and inner point of curved portion in inner subdorsum; submedian pores in an oblong arrangement; a pair of submedian disk pores present on second abdominal segment but absent from abdominal segments 5–7; no subdorsal disk pores on eighth abdominal segment; submarginal papillae broad, their apices usually

broadly curved, measuring 8–10 μ long and 12–16 wide. Unmounted insects with a copious secretion of white, somewhat fibrous, waxy material arising in several columns from outer part of body, and in a single column from center of body *pergandei* (Quaintance), p. 57.

Dorsal disk pores less numerous or arranged differently than in *pergandei;* a pair of submedian disk pores absent from second abdominal segment except in *fernaldi,* but a pair present on each of abdominal segments 5–7; subdorsal disk pores on eighth abdominal segment; submarginal papillae varying in form, but different in size if shaped as in *pergandei.* Unmounted insects without a secretion of white, somewhat fibrous, waxy material ---------- 26

26. Usually more than 2 pairs of subdorsal disk pores on some cephalothoracic segments and more than 1 subdorsal pair on each of abdominal segments 3–8; derm varying in color in mature pupae but rather heavily sclerotized and strongly sculptured in any case; a spine around 10 μ long and one about 4 μ long on each leg; submarginal papillae apparently always well developed and conical, but with striking variation in arrangement ---------- *vittata* (Quaintance), p. 65.

Usually only 2 pairs of subdorsal disk pores on any cephalothoracic segment and only 1 subdorsal pair on each of abdominal segments 3–8; derm varying in color but partially or entirely black if heavily sclerotized and strongly sculptured; spines either smaller than above or only 1 well defined on each leg, except in *magnoliae* and *ruborum;* submarginal papillae variable ---------- 27

27. Operculum at least as long as lingula and covering all, or all but the tip, of that structure; elongate setae of lingula not reaching rim of orifice ---------- 28

Operculum not so long as lingula and reaching only to the third pair of lobes of that structure; elongate setae of lingula reaching beyond rim of orifice except in *fernaldi* ---------- 29

28. Submarginal papillae somewhat conical, longer than wide, the majority uniform in size, around 16 μ long and 14 wide, arranged in a single row, contiguous at base; around 24 marginal crenulations in 100 μ; posterior marginal setae 20 μ long; elongate setae on legs 12 μ long; spines on legs small, only 2–4 μ long; dark portion of dorsum not extending to margin of body *heucherae,* new species, p. 68.

Submarginal papillae not conical, wider than long with their tips slightly produced, varying in size, 10–16 μ long and 12–24 wide, arranged in a double row, some almost contiguous at base but others farther apart; around 20 marginal crenulations in 100 μ; posterior marginal setae 40 μ long; elongate setae on legs 8 μ long; spines on legs larger, one 8–12 μ long and another 4 μ long; dark portion of dorsum extending to margin at ends of body *magnoliae,* new species, p. 69.

29. (27) Two prominent spines on each leg, about 10 μ long and the other around 6 μ; submarginal papillae broad, their apices curved, when well developed largest ones around 16 μ long and 24 wide; dorsum black, thick, strongly sclerotized and sculptured *ruborum* (Cockerell), p. 64.

One spine 4–7 μ long and a rather poorly defined minute one on each leg; submarginal papillae degenerate or well developed, but if the latter not quite so broad as above, their apices rather blunt but not curved, largest ones 16 μ long and 20 wide; dorsum yellowish or colorless, not so thick as in *ruborum,* usually weakly sclerotized and sculptured ---------- 30

30. A pair of submedian disk pores present on second abdominal segment; usually 2 pairs of submedian disk pores on prothoracic segment ---------- *fernaldi* (Morrill), p. 63.

A pair of submedian disk pores absent from second abdominal segment; usually 1 pair of submedian disk pores on prothoracic segment ---------- *packardi* (Morrill), p. 59.

31. (24) Body broadly elliptical to nearly subcircular in outline, 0.70–0.90 mm. long and 0.50–0.70 wide; dorsal papillae absent; 115–176 submarginal papillae arranged in a single, well-defined row which is usually continued across posterior end of body, their bases usually contiguous and their apices in line with body margin or overlapping it; submarginal setal bases more than the width of a papilla mesad of submarginal disk pores; first and eighth abdominal and caudal setae each around 12 μ long, the bases of the caudal pair anterior to submarginal papillae; operculum practically truncate posteriorly, extending to anterior lobes of lingula--------*euphorbiae*, new species, p. 77.

Body varying in outline but not so stout as above, if 0.70–0.90 mm. long, then 0.45–0.60 wide; dorsal papillae present or absent; fewer than 115 submarginal papillae, varying in arrangement but the row interrupted at posterior end of body in any case, the papillae usually not contiguous, and their apices usually not reaching body margin; submarginal setal bases much nearer submarginal disk pores than in *euphorbiae;* first and eighth abdominal and caudal setae each not around 12 μ long, the bases of the caudal pair usually about in line with submarginal papillae except in *eriodictyonis;* operculum not truncate posteriorly, extending at least to second lobes of lingula---------- 32

32. Papillae very numerous, distributed from submargin to inner subdorsum and some median ones present on cephalothorax, the submarginal row poorly differentiated from dorsal ones, 8–12 μ long and wide; operculum extending to terminal lobe of lingula and covering all of lingula except terminal lobe and tips of posterior lateral lobes; a dark, irregular band covering part of submedian and subdorsal area of dorsum *colcordae*, new species, p. 75.

Papillae less numerous than in *colcordae* even if distributed similarly, the submarginal row well or rather poorly differentiated from dorsal ones, more variation in size than 8–12 μ long and wide; operculum sometimes extending to terminal lobe of lingula but if so not covering all of its middle or posterior lateral lobes; without a dark band as in *colcordae* though sometimes dark in center or over much of dorsum------------------------------ 33

33. Body somewhat elliptical in outline, its posterior end fairly broad; operculum at least as wide as long, rather narrowly to broadly curved posteriorly, reaching almost or quite to third lobes of lingula; a strong, peglike tooth rising vertically at posterior end of vasiform orifice; eighth abdominal and caudal setae ranging from rather small to large but less than 85 μ long, area around bases of the eighth abdominal ones not strongly tuberculate; papillae broadly conical, their apices rather blunt, measuring 8–16 μ long and 12–24 wide; ventral abdominal setae about 40 μ long---------------------*abutilonea* (Haldeman), p. 71.

Body ovoid in outline, its posterior end strongly narrowed; operculum longer than wide, more narrowly curved posteriorly than in *abutilonea*, reaching almost or quite to terminal lobe of lingula; no strong, peglike tooth rising vertically at posterior end of vasiform orifice; eighth abdominal and caudal setae particularly large, 85–130 μ long, area around bases of the eighth abdominal ones strongly tuberculate; papillae nearly conical, their apices acute, measuring 8–16 μ long and wide; ventral abdominal setae about 52 μ long-------------*eriodictyonis*, new species, p. 76.

TREATMENT OF SPECIES

The Nearctic species of *Trialeurodes* fall into six fairly well defined natural groups, and they are so arranged in this publication. The order in which the groups are taken up is an attempt at a phylogenetic arrangement, but it is necessarily somewhat arbitrary owing to the difficulty of ascertaining where some segregates fit in. The groups considered first, however, appear to be less highly specialized than those discussed later in the publication.

Characters of proved diagnostic value are treated in the group discussions or in the individual descriptions, or are depicted in the illustrations. The absence of structures sometimes is not noted, however, and the submarginal and dorsal wax rods usually are not mentioned because of their close association with the papillae, which can be studied more satisfactorily. The quantitative data included herein express the range of variation found in the insects examined; in cases where few specimens have been studied these limits probably will be expanded by the examination of additional insects, particularly if they are found on leaves that are dissimilar to those from which the species are here reported. Only data on the insects studied by the writer are included under hosts and distribution of species; type specimens of the species described previously are indicated immediately after their respective hosts and localities.

FLORIDENSIS GROUP

The Floridensis Group is composed of eight species—*floridensis*, *intermedia*, *vitrinellus*, *coccolobae*, *bellissima*, *multipori*, *oblongifoliae*, and *mirissimus*. Although all these species are closely related, the first six appear to be more closely related to one another than they are to the last two, which in turn are rather similar to each other. The group as a whole, and the individual species, show less variation than other groups and many other species treated in this publication. It apparently is the most stable group discussed herein.

These species are known only from the southern and southwestern part of the Nearctic Region and the northern part of the Neotropical Region, and doubtless are indigenous to these areas. In material examined by the writer, each species was found on glabrous or glabrate leaves. *Trialeurodes floridensis* often literally covers the lower surface of leaves and has been reported as injurious, but the other species have not been so regarded even though *vitrinellus* occurs on a host of economic importance, and *intermedia* sometimes is abundant. The other species are known from relatively few specimens.

Characters common to the group are outlined as follows:

Abundant, white, fibrous secretions absent. Dorsal layer of wax pitted and striated, tough and leathery, adhering to derm, usually present even after insects have gone through chemicals used in mounting procedure, and, though transparent, tending to obscure characters. Ventral layer of wax less pitted and tough than dorsal layer and often sloughing off during mounting. Nearly colorless or pale yellowish, sometimes with brownish areas. Dorsum very lightly sclerotized, ventral derm almost entirely membranous.

Marginal crenulations and submarginal ridges rather broad, strong for this genus, the latter extending to papillae. Submarginal papillae elongate in ventral view, rather conical or elongate in dorsal view, the under side of their distal ends more heavily sclerotized than the upper side, and distal two-thirds of papillae usually more heavily sclerotized than basal third; inner ends of papillae somewhat convex, distal ends acute, the majority usually about the width of a papilla from body margin; papillae nearly contiguous at base, arranged in a single row. Submarginal disk pores in upper part of basal ends of papillae. Submarginal porettes in sides of papillae, almost indistinguishable. Apparently 8 pairs of submarginal setal bases on cephalothorax and 7 pairs on abdomen, situated about the length of a papilla from papillae, most of them with barely distinguishable setae.

Dorsal papillae absent. Dorsal porettes usually nearly indistinguishable. Transverse molting suture curved posteriorly from its center but recurved and reaching papillae opposite a point slightly anterior to midpoint of mesometathoracic suture. Seven or eight segments evident in median area of abdomen. Pockets small, about the width of a pocket apart. Anterior marginal, cephalic, and first abdominal setae present; dorsal setae usually rather stout and naillike, their bases large and prominent; eighth abdominal pair usually opposite widest part of orifice and slightly nearer to it than to nearest suture; bases of caudal pair anterior to papillae and their tips hardly surpassing body margin. Vasiform orifice subcordate, usually as wide as long; its anterior end (not the rim) around width of orifice from seventh abdominal suture and its posterior end around twice length of orifice from body margin; rim of orifice defined around entire cavity, flat and 6–10 μ long at anterior end, vertical elsewhere, occasionally a small notch at posterior end; sides of orifice nearly vertical, its bottom strongly concave. Operculum usually subcordate, occupying at least seven-tenths of orifice, covering entire lingula or all but posterior margin of terminal lobe, usually not extending beyond its tip. Lobes of lingula usually small, long setae of lingula contained in orifice. Grooves beside orifice and caudal furrow usually distinct and narrow.

Inner basal area of anterior and middle legs slightly sclerotized, the latter slightly sculptured and sometimes bearing 1 or 2 minute spines; a seta about 8 μ long on each middle and posterior leg. Anterior abdominal spiracles distinct.

TRIALEURODES FLORIDENSIS (Quaintance)

Aleurodes floridensis Quaintance, 1900, U. S. Dept. Agr., Div. Ent., Tech. Ser. 8: 26–27, illus.

Asterochiton floridensis (Quaintance), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.

Trialeurodes floridensis (Quaintance), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi.

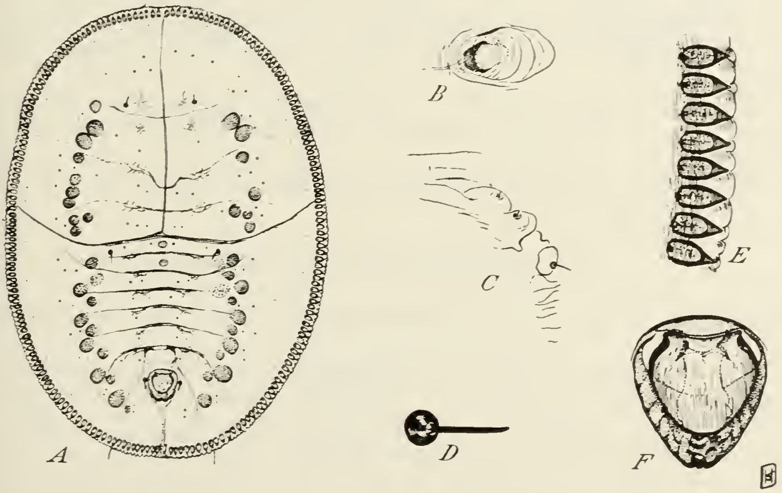

FIGURE 1.—*Trialeurodes floridensis*: *A*, Outline; *B*, thoracic spiracle; *C*, part of inner basal area of middle leg; *D*, first abdominal seta; *E*, section of margin and submargin; *F*, vasiform orifice.

With the characters of the group. Mounted insects 0.75–0.90 mm. long and 0.50–0.65 wide. Marginal crenulations varying in width, a narrow one often alternating with one about twice its width, approximately 16 in 100 μ; each tracheal pore area indicated by narrowness of 5–8 crenulations. Submarginal papillae totaling 148–255, slightly conical in dorsal view, their sides beginning to converge near inner end, measuring 14–16 μ long and 8–10 wide.

Eight segments apparent in median area of abdomen. Subdorsal tubercles 8–20 μ in diameter, some usually prominent and brownish, usually absent from cephalic and eighth abdominal segments, often a large and a small pair on other segments; a single median one on each of abdominal segments 1 and 2. Pairs of disk pores distributed about as follows: Cephalic segment, 4 or 5 subdorsal;[8] prothoracic, 3 or 4 subdorsal and 1 or 2 submedian; mesothoracic, 4 or 5 subdorsal and 1 or 2 submedian; metathoracic, 2 or 3 subdorsal and submedian; first abdominal, 2 submedian; second abdominal, 0 or 1 submedian; third abdominal, 3 subdorsal and 1 or 2 submedian; fourth through seventh abdominal, each 1 or 2 subdorsal and submedian; eighth abdominal, 1 or 2 subdorsal (usually 2 subdorsal and 1 submedian on abdominal segments 4–7). Length of setae about as follows: Anterior marginal, 4 μ; cephalic, 16 μ; first abdominal, 20 μ; eighth abdominal, 12–16 μ; caudal, 12 μ; posterior marginal, 28 μ. Vasiform orifice 44–56 μ long and 40–52 wide, its bottom slightly rugose in center. Operculum 32–40 μ long and 36–40 wide. Lingula 24–28 μ long and 20 wide.

Ventral abdominal setae 20 μ long.

Hosts.—*Acacia pallens* Rolfe, *Albizzia moluccana* Miq., *Annona diversifolia* Safford, *A. squamosa* L., *Bombax malabaricum* DC., *Cassia nodosa* Buch.-Ham., *Cassia* sp., *Chomelia spinosa* Jacq., *Citrus* sp., *Clausena lansium* Skeels, *Coccoloba uvifera* L., *Dodonaea thunbergiana* Eckl. and Zeyh., *Eucalyptus botryoides* Smith, *Geobalanus* sp., *Guaiacum guatemalense* Planch., *Ipomoea* sp., *Lagerstroemia speciosa* (Muench) Pers., *Malpighia glabra* L., *Mangifera* sp., *Melia azedarach* L., *Mimusops emarginata* (L.) Britton, *Persea americana* Mill., *Petrea volubilis* L., *Psidium guajava* L. (cotypes and other specimens), *Randia calophylla* Griseb., *Tetracera volubilis* L., *Tristania conferta* R. Br.

Distribution.—Florida: Arcadia, Brooksville, Buena Vista, Chapman Field, Crescent City (cotypes), Estero, Eustis (cotypes), Fort Myers, Gainesville, Homestead, Little River, Matheson Key, Miami, Redland, Stuart, Tampa, West Palm Beach, Winter Haven, Winter Park.

Bahama Islands: Nassau. Canal Zone: Ancon, Cano Quebrado. Cuba: Cerro, Habana, Palacios, Vedado, Vibora. Puerto Rico: San Juan.

Redescribed from an abundance of unmounted material and around 500 mounted specimens.

TRIALEURODES INTERMEDIA, new species

Trialeurodes vitrinellus Cockerell, Quaintance and Baker, 1916, Jour. Agr. Res. 6: 470, in part.

The specimens reported by Quaintance and Baker on oak from southern California belong to *intermedia* rather than to *vitrinellus*.

Characteristic of group. Mounted insects 0.90–1.10 mm. long and 0.60–0.90 wide. Marginal crenulations uniform in width, 10–12 in 100 μ; each tracheal pore area marked by narrowness of 5–7 crenulations. Submarginal papillae totaling 242–308, rather elongate in dorsal view, about 24 μ long and 10 wide.

Eight segments apparent in median area of abdomen. Pairs of dorsal disk pores arranged approximately as follows: Cephalic segment, 4 subdorsal; each

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[8] The terms "subdorsal" and "submedian" are used rather loosely in describing the location of pores, because, if numerous, they are spread out and may occupy an intermediate position. All pores on the cephalic segment are termed "subdorsal" unless they are near both the median line and the posterior edge of the segment. There may be 1 or more pores on one half of a segment than on the other half.

thoracic segment, 2–4 subdorsal and 1 or 2 (usually 2) submedian; first abdominal, 3 or 4 submedian; second abdominal, 0 or 1 submedian; third through sixth abdominal, each 2 or 3 subdorsal and 1 (occasionally 2) submedian; seventh abdominal, 1–3 subdorsal and 2 or 3 submedian; eighth abdominal, 2 or 3 subdorsal. Length of setae about as follows: Anterior marginal, 4 μ; cephalic, 8–12 μ; first abdominal, 8–16 (rarely 24) μ; eighth abdominal, 8–16 μ; caudal, 8–12 μ: posterior marginal, 16–20 μ. Vasiform orifice 48–52 μ long and 52–58 wide, its bottom smooth. Operculum 36–40 μ long and 44–48 wide. Lingula 32–36 μ long and 20 wide.

Ventral abdominal setae apparently 28 μ long.

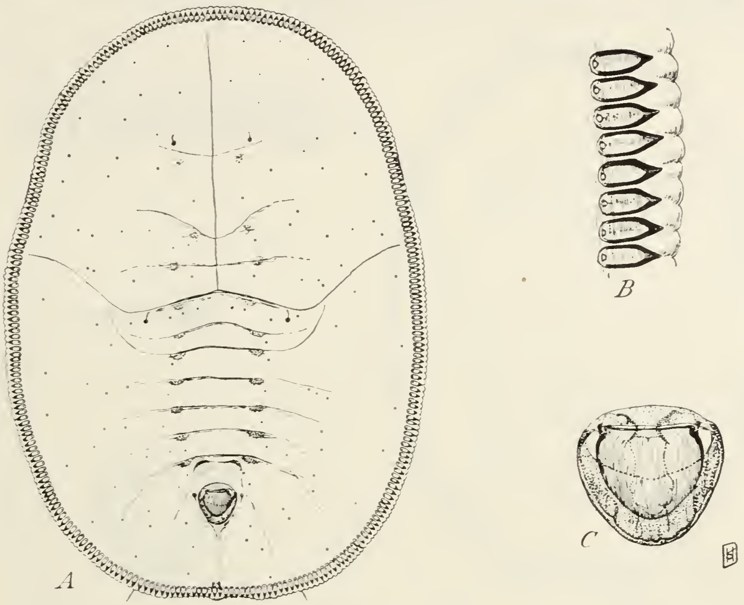

FIGURE 2.—*Trialeurodes intermedia*: *A*, Outline; *B*, section of margin and submargin; *C*, vasiform orifice.

HOSTS.—*Quercus agrifolia* Nées?, *Quercus* sp., *Rhamnus crocea* Nutt., *Rhamnus* sp., *Rhus ovata* S. Wats., *Rhus* sp.

DISTRIBUTION.—California: Near Irvine station (Orange County), Jacumba, Mount Lowe, Mount Wilson, San Jacinto Mountains, Sierra Madre, southern California, and unstated localities.

Described from a few unmounted and approximately 100 mounted specimens as follows: *Q. agrifolia*?, Sierra Madre, R. S. Woglum, December 1907; *Quercus* sp., southern California, R. S. Woglum, December 1908; *R. crocea*, Mount Wilson, no other data; *R. crocea*, San Jacinto Mountains, J. C. Bridwell, July 27, 1912; *R. crocea*, Mount Lowe, P. H. Timberlake, September 8, 1912 (holotype and paratypes); *R. crocea*, near Irvine station, R. K. Bishop, September 27, 1945; *Rhamnus* sp., southern California, R. S. Woglum, December 1907; *Rhamnus* sp., no other data; *R. ovata*, Mount Wilson, no other data; *Rhus* sp., Jacumba, E. A. McGregor, July 11, 1916.

Specimens which apparently belong to this species but which are not included in the type series are at hand from *Amyris texana* (Buckl.) P. Wilson, Mission, Tex., F. F. Bibby, April 4, 1927.

TRIALEURODES VITRINELLUS Cockerell

Aleyrodes (*Trialeurodes*) *vitrinellus* Cockerell, 1903, Ent. News 14: 241.
Aleyrodes vitrinellus Cockerell, 1909, Ent. News 20: 215.
Asterochiton vitrinellus (Cockerell), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.
Trialeurodes vitrinellus Cockerell, Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi; Quaintance and Baker, 1916, Jour. Agr. Res. 6: 470, in part.

As stated on page 20, some of the specimens referred to *vitrinellus* by Quaintance and Baker in 1916 belong to *intermedia*.

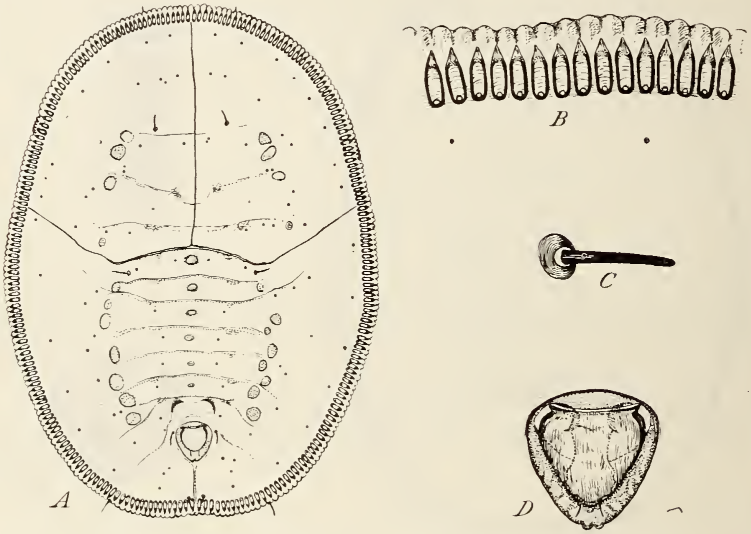

FIGURE 3.—*Trialeurodes vitrinellus*: *A*, Outline; *B*, section of margin and submargin, showing submarginal setal bases; *C*, first abdominal seta; *D*, vasiform orifice.

With the characters of the group. Mounted insects 0.90–1.05 mm. long and 0.65–0.80 wide. Marginal crenulations nearly uniform in width, around 10 in 100 μ; each tracheal pore area marked by narrowness of 3–6 crenulations. A total of 230–295 submarginal papillae, rather elongate in dorsal view, their sides nearly parallel on basal half, measuring 20–24 μ long and 8–10 wide.

Eight segments evident in median area of abdomen. One or two pairs of subdorsal tubercles on majority of segments but usually absent from cephalic and eighth abdominal, a median tubercle on each of abdominal segments 1–6, 12–20 μ in diameter but usually rather inconspicuous. Pairs of disk pores arranged approximately as follows: Cephalic segment, 4 subdorsal; prothoracic, 2 or 3 subdorsal and 2 submedian; mesothoracic, usually 2 subdorsal and 1 submedian; metathoracic, 2 subdorsal and 1 or 2 submedian; first abdominal, 2 or 3 submedian; second abdominal, 0; third, 3 (rarely 4) subdorsal and 1 submedian; fourth, fifth, sixth, and seventh abdominal, each 1 or 2 subdorsal (usually 1) and 1 submedian; eighth, 2 or 3 subdorsal. Length of setae about as follows: Anterior marginal, 8 μ; cephalic, 24 μ; first abdominal, 20μ; eighth abdominal, 16μ; caudal, 12–16 μ; posterior marginal, 24 μ. Vasiform orifice 48–60 μ long and 50–60 wide, its bottom faintly lined. Operculum 36–44 μ long and 40–48 wide. Lingula 30 μ long and 20 wide.

Ventral abdominal setae 24 μ long.

HOST.—Orange (cotypes and other specimens).

DISTRIBUTION.—Mexico: Puebla, State of Puebla; Texcoco, State of Mexico (cotypes); and unstated localities.

Redescribed from a few unmounted and about 100 mounted specimens.

TRIALEURODES COCCOLOBAE, new species

Characteristic of group. Mounted insects 1 mm. long and 0.75 wide. Marginal crenulations nearly uniform in width, around 12 in 100 μ; each tracheal pore area strongly marked by narrowness and depth of 6–9 crenulations. Submarginal papillae totaling 215, 20–24 μ long and 10–12 wide, rather elongate in dorsal view.

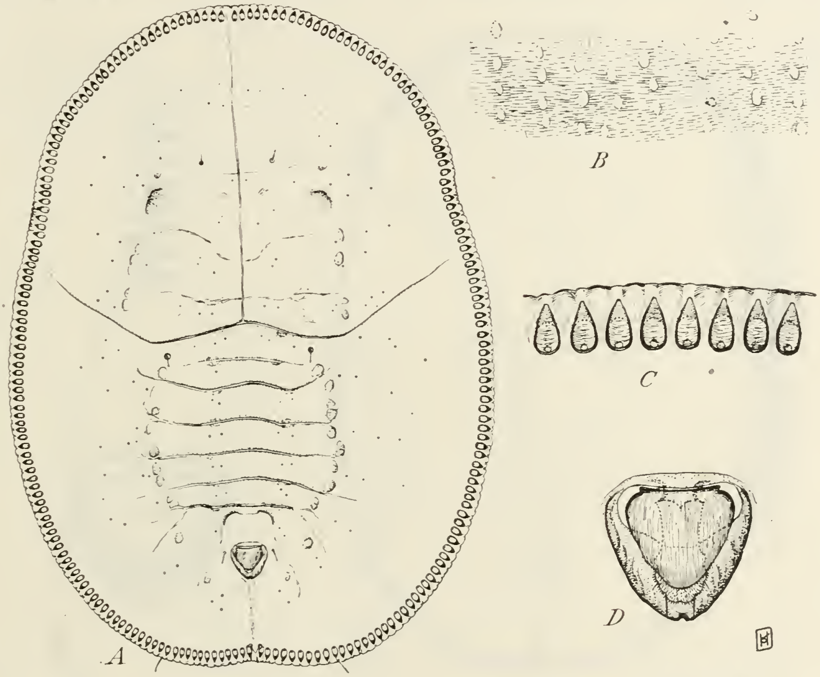

FIGURE 4.—*Trialeurodes coccolobae*: *A*, Outline; *B*, portion of dorsal waxy covering; *C*, section of margin and submargin; *D*, vasiform orifice.

Eight segments apparent in median area of abdomen. A pair of subdorsal tubercles around 36 μ in diameter on prothoracic segment and 1 or 2 much smaller subdorsal pairs on majority of other segments. Pairs of disk pores distributed about as follows: Cephalic segment, 9 subdorsal; prothoracic and mesothoracic segments, each 4–6 subdorsal and 2–4 submedian; metathoracic, 2 or 3 subdorsal and 4 submedian; first abdominal, 1–3 subdorsal and 3 submedian; second abdominal, 0 or 1 submedian; third abdominal, 5 subdorsal and 2 submedian; fourth and fifth, each 3 or 4 (usually 3) subdorsal and 2 submedian; sixth, 2 or 3 subdorsal and 2 submedian; seventh, 1 or 2 subdorsal and submedian; eighth abdominal, 2 or 3 subdorsal. Length of setae about as follows: Anterior marginal, 6 μ; cephalic, 22 μ; first abdominal, 22 μ; eighth abdominal, 16 μ; caudal, 8 μ; posterior marginal, 20 μ. Vasiform orifice 52 μ long and wide, its bottom smooth. Operculum 36–40 μ long and 40–44 wide. Lingula 32–36 μ long and 20 wide.

Ventral abdominal setae 28 μ long.

Host.—*Coccoloba floribunda* (Benth.) Lindau.

Distribution.—Mexico: Near Manzanillo, State of Colima.

Described from the holotype and one paratype (observed before as well as after mounting) removed from a plant in the United States National Herbarium by Marjorie J. Camp; the plant was collected by Roxana S. Ferris, December 2, 1925.

TRIALEURODES BELLISSIMA (Sampson and Drews)

Gymnaleurodes bellissima Sampson and Drews, 1940, Pan-Pacific Ent. 16: 29–30, illus.

Trialeurodes bellissima (Sampson and Drews), Sampson, 1943, Ent. Amer. (n. s.) 13: 209.

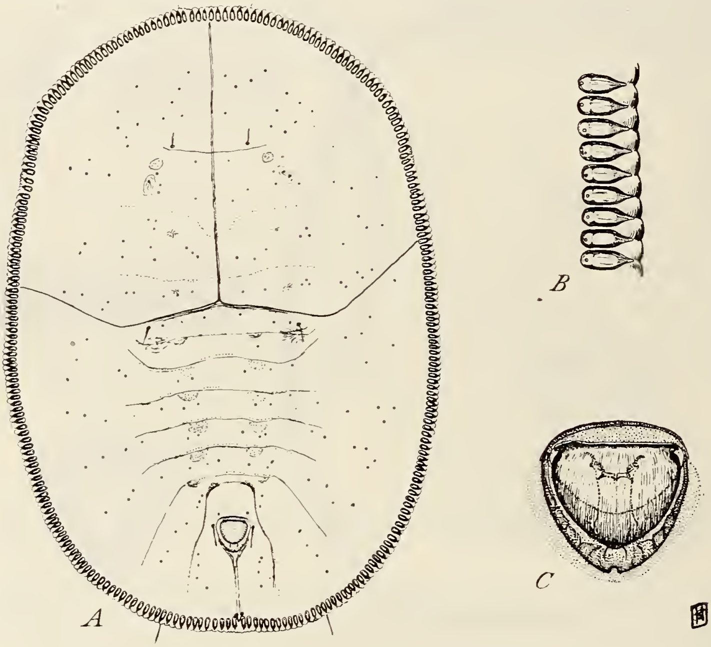

Figure 5.—*Trialeurodes bellissima*: *A*, Outline; *B*, section of margin and submargin; *C*, vasiform orifice.

With the characteristics of the group. Usually a pair of brownish subdorsal spots on prothoracic segment and a submedian pair extending from first to second abdominal segment. Mounted specimens 1–1.35 mm. long and 0.75–1 wide. Marginal crenulations slightly variable in width, around 12 in 100 μ; each tracheal pore area indicated by narrowness of 4–8 crenulations. Submarginal papillae totaling 308–369, measuring 18–20 μ long and 8–10 wide, rather elongate in dorsal view.

Eight segments apparent in median area of abdomen. One or two pairs of rather inconspicuous submedian or subdorsal tubercles on prothoracic segment. Pairs of dorsal disk pores distributed about as follows: Cephalic segment, 12 subdorsal; each thoracic segment, 3 or 4 subdorsal and 5–7 submedian; first abdominal, 3 submedian; second abdominal, 0 or 1 submedian; third through seventh abdominal, each 4 or 5 subdorsal and 2 or 3 submedian; eighth abdominal, 4 subdorsal and 1 (anterior to orifice) submedian. Length of setae about as follows: Anterior marginal, 4 μ; cephalic, 20 μ; first abdominal, 20 μ; eighth abdominal, 20 μ; caudal, 12 μ; posterior marginal, 24 μ. Vasiform orifice 56–64 μ long and

58–68 wide, its bottom smooth. Operculum 40–52 μ long and 48–56 wide. Lingula 36 μ long and 22 wide.

Ventral abdominal setae 24 μ long.

Hosts.—*Quercus agrifolia* Nées, *Quercus* sp. (paratype and other specimens).

Distribution.—California: Carbon Canyon (San Bernardino County) (paratype), Los Angeles, Pasadena, Puente Hills, San Bernardino, Whittier.

Redescribed from several unmounted and 27 mounted insects. The paratype specimen was received from E. O. Essig.

TRIALEURODES MULTIPORI, new species

Characteristic of group. A dark curved band extending from cephalic setae to vasiform orifice. Mounted insects 1–1.35 mm. long and 0.80–1 wide. Marginal crenulations practically uniform in width, around 10 in 100 μ; tracheal pore areas inevident. A total of 300–319 submarginal papillae, 22–28 μ long and 8–10 wide, elongate in dorsal view, their sides parallel except near outer end.

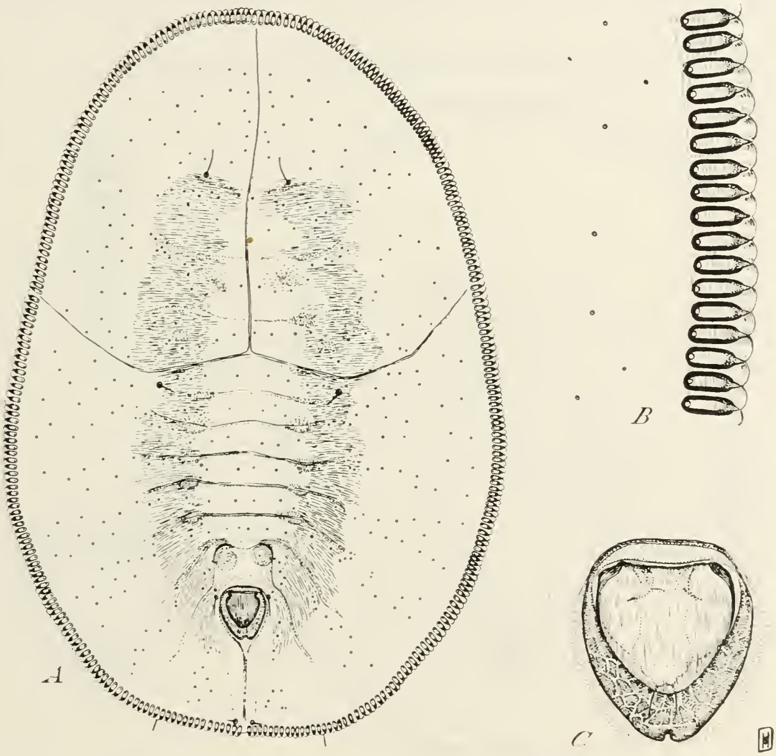

Figure 6.—*Trialeurodes multipori: A,* Outline; *B,* section of margin and submargin; *C,* vasiform orifice.

Eight segments apparent in median portion of abdomen. Dorsal disk pores very numerous, distributed across dorsum and tending toward arrangement in irregular single or double rows on each segment but also in groups on cephalothorax; 11–22 pairs per segment except on first, second, and eighth abdominal ones, each of which has 5–10 pairs; pairs of pores arranged approximately as follows: Cephalic segment, 13–18 subdorsal and 2–5 submedian; each thoracic segment, 8–11 subdorsal and submedian; first abdominal, 2–5 subdorsal and 4 or 5 submedian; second abdominal, 3–5 subdorsal and 2 or 3 submedian; third through seventh abdominal, each 8–16 subdorsal and 3–5 submedian; eighth abdominal, 7–10 subdorsal and 1 (located anterior to eighth abdominal setae) submedian. A pair of conspicuous swollen areas posterior to pockets. Length of setae about as follows: Anterior marginal, 2 μ; cephalic, 30–36 μ; first abdominal, 20 μ; eighth abdominal (anterior to widest part of orifice), 20–24 μ; caudal, 16 μ; posterior marginal, broken, probably 20–24 μ. Vasiform orifice 60–68 μ long and 60–64 wide, heavily sclerotized, ridged near top but elsewhere netted by grooves. Operculum 48–52 μ long and wide. Lingula 40–44 μ long and 24 wide.

Ventral abdominal setae 28 μ long.

Host.—*Quercus oblongifolia* Torr.

Distribution.—Arizona: Nogales, and at base of Santa Catalina Mountains.

Described from several unmounted and five mounted specimens. Holotype and paratypes from leaves collected by C. G. Pringle at the base of Santa Catalina Mountains, April 4, 1881, and deposited in the United States National Herbarium; one paratype collected at Nogales by L. H. Weld, February 12, 1935.

TRIALEURODES OBLONGIFOLIAE, new species

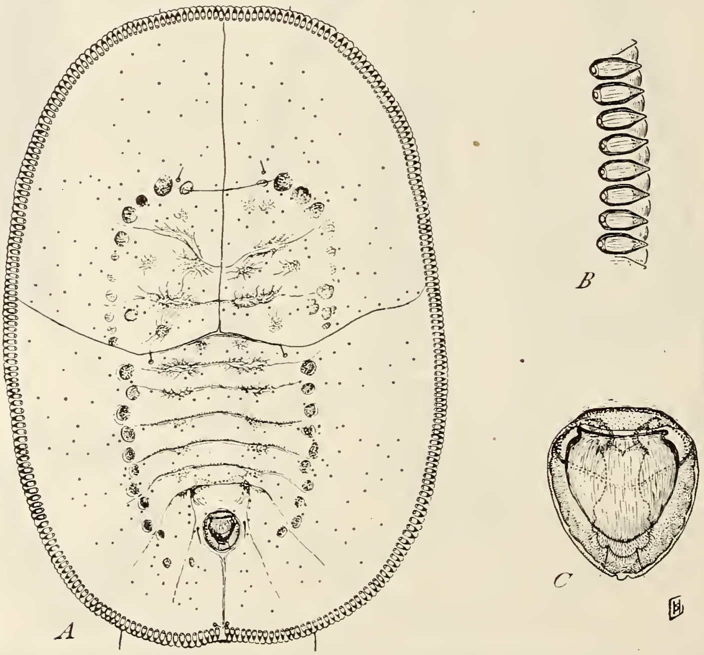

Figure 7.—*Trialeurodes oblongifoliae: A,* Outline; *B,* section of margin and submargin; *C,* vasiform orifice.

Characteristic of group. Mounted insects 1–1.20 mm. long and 0.75–0.85 wide. Marginal crenulations uniform in width, around 10 in 100 μ; usually thoracic tracheal pore areas inevident and abdominal one marked by narrowness of 3 or 4 crenulations. A total of 282–368 submarginal papillae, 20 μ long and 8 wide, elongate in dorsal view, their sides nearly parallel except near outer end.

Seventh abdominal suture as far cephalad as sixth in median area so that only 7 abdominal segments are visible medially. Usually 2 pairs of subdorsal tubercles on each segment, some located posterior to cephalic setae, 12–24 μ in diameter, usually brownish and conspicuous. Disk pores very numerous, particularly in subdorsum, tending toward arrangement in irregular single or double rows on abdomen but somewhat scattered on cephalothorax; pairs of pores arranged approximately as follows: Cephalic segment, 18–20 subdorsal and 2 or 3 submedian; each thoracic segment, 8–10 subdorsal and 9–11 submedian; first abdominal, 4 or 5 submedian; second abdominal, 2 or 3 subdorsal and submedian; third through seventh abdominal, each 5–9 (usually 8) subdorsal and 4 or 5 submedian; eighth abdominal, 5–7 subdorsal and 2 or 3 submedian (1 located anterior to orifice, 1 sometimes present laterad of eighth abdominal setae, and 1 well posterior to those setae). Length of setae approximately as follows: Anterior marginal, 4 μ; cephalic, first and eighth abdominal, each 20–24 μ; caudal, 12–16 μ; posterior marginal, 24 μ. Vasiform orifice 56–68 μ long and wide, its bottom smooth. Operculum 44–56 μ long and wide. Lingula 44–56 μ long and 24–30 wide.

Ventral abdominal setae 24 μ long.

Host.—*Quercus oblongifolia* Torr.

Distribution.—Arizona: Base of Santa Catalina Mountains; Stone Cabine Canyon, Santa Rita Mountains.

Mexico: Nogales, State of Sonora.

Described from a few unmounted and six mounted specimens as follows: From leaves in the United States National Herbarium, collected by C. G. Pringle, Santa Catalina Mountains, April 4, 1881, and by Ivar Tidestrom, Stone Cabine Canyon, May 5, 1927; holotype and paratypes collected at Nogales by Albert Koebele, May 3, 1897.

TRIALEURODES MIRISSIMUS Sampson and Drews

Trialeurodes mirissimus Sampson and Drews, 1941, An. de la Escuela Nac. Cien. Biol. [Mexico] 2: 179, illus.

Characteristic of group. Mounted insects around 1 mm. long and 0.70 wide. A pair of sclerotized, brownish, submedian spots extending from first to second abdominal segment. Marginal crenulations nearly uniform in width, around 10 in 100 μ; each tracheal pore area indicated by narrowness of 3 or 4 crenulations. Submarginal papillae totaling around 224, around 20 μ long and 12 wide, somewhat conical in dorsal view, sides starting to converge nearer base than tip.

Median portion of seventh abdominal suture as far cephalad as sixth, only 7 abdominal segments visible medially. Subdorsal tubercles in an elliptical arrangement passing just posterior to cephalic setae but 1 or 2 also laterad of these setae, 2 pairs on majority of segments, majority brownish and conspicuous, some as much as 40 μ long but majority around 24 μ in diameter. Pairs of disk pores distributed about as follows: Cephalic segment, 9 subdorsal and 1 submedian; each thoracic segment, 4–8 subdorsal and 3–5 submedian; first abdominal, 2 submedian; second abdominal, 0; third through seventh abdominal, each 3 or 4 (rarely 5) subdorsal and 2 submedian; eighth abdominal, 4–6 subdorsal. Length of setae approximately as follows: Anterior marginal, broken at base; cephalic, broken, at least 12 μ; first abdominal, 24 μ; eighth abdominal, broken near base; caudal, 20–24 μ; posterior marginal, apparently 28 μ. Vasiform orifice 64 μ long and 56 wide, its bottom smooth. Operculum 56 μ long and 52 wide, rather narrow posteriorly, extending beyond tip of lingula. Lingula 44 μ long and 28 wide.

Length of ventral abdominal setae indeterminable.

Host.—"Sapote" (probably *Casimiroa edulis* Llav. and Lex.) (holotype and paratype).

Distribution.—Mexico: Near Mazatlan, State of Sinaloa (holotype and paratype).

Redescribed from two mounted specimens loaned by W. W. Sampson.

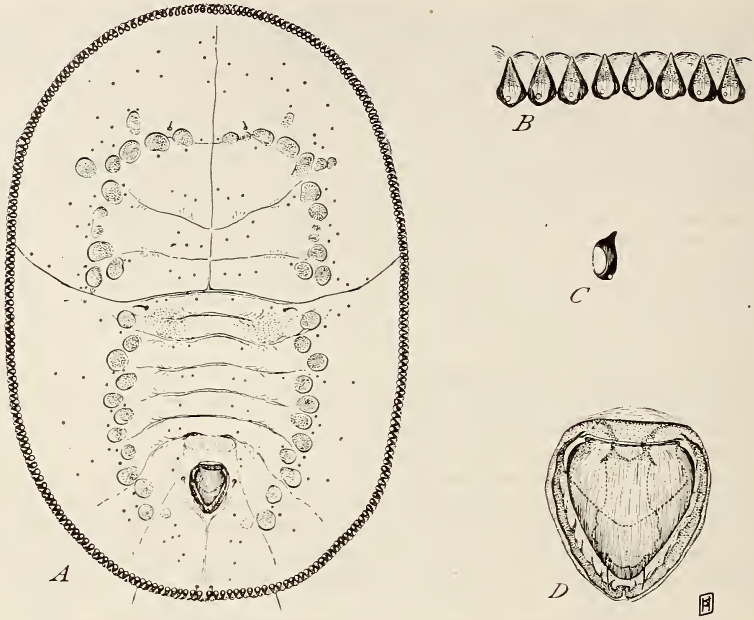

Figure 8.—*Trialeurodes mirissimus: A*, Outline; *B*, section of margin and submargin; *C*, side view of papilla; *D*, vasiform orifice.

Variabilis Group

Only three species are known which are assignable to the Variabilis Group, namely, *variabilis*, *similis*, and *tephrosiae*. These species are closely related to one another, and the group is well defined. Although the group appears to be most closely related to the Floridensis, Hutchingsi, and Vaporariorum Groups, on the basis of first-stage larvae and adults as well as pupae, its closest relatives are rather uncertain. The adults seem most similar to those of the Floridensis Group, however. It is known in the Neotropical Region and the southern part of the Nearctic Region and is doubtless a Neotropical group whose natural distribution extends into the Nearctic Region.

All three species were abundant on leaves examined by the writer, and *variabilis* has been reported as destructive to papaya. The writer has seen *variabilis* only on smooth leaves and *similis* and *tephrosiae* only on moderately to extremely pubescent ones, all specimens found being on the lower surface.

Characteristics of the group follow.

Without flocculent waxy secretions. Dorsal and ventral layers of wax not adhering to derm, easily separable from it. Derm pale yellow or colorless, membranous, thin.

Marginal crenulations very shallow, slightly variable in width, approximately 14 in 100 μ; submarginal ridges rather flat and inconspicuous, defined close to margin; abdominal tracheal pore area indicated by narrowness or depth of 2–4 crenulations. Submarginal papillae broadly conical when well developed. Majority of submarginal disk pores distad of papillae and closer to them than to body margin, but an occasional one (sometimes almost half of them in *tephrosiae*) mesad or laterad of papillae. Submarginal porettes nearly indistinguishable, in bases of papillae. Submarginal setal bases apparently in 8 pairs on cephalothorax and in 7 pairs on abdomen, in line with or slightly mesad of papillae.

Dorsal disk pores arranged approximately as follows: A submedian pair on each segment except second, sixth, and eighth abdominal (or 2 pairs on first abdominal); usually 2 subdorsal pairs on each cephalothoracic and third abdominal segment and 1 subdorsal pair on each of posterior 5 abdominal segments. Dorsal porettes very minute, barely distinguishable. Dorsal papillae broadly conical when well developed. Transverse molting suture curved posteriorly from its center but recurved and reaching submarginal papillae just about opposite its midpoint. Only 7 segments apparent in median section of abdomen. Pockets moderate in size, less than the width of a pocket apart. Anterior marginal, cephalic, and first abdominal setae present, all setae slender and tapering; eighth abdominal setae opposite, or anterior to, widest part of orifice and as near to seventh abdominal suture as to orifice. Vasiform orifice cordate, its posterior end one to one and one-fourth times length of orifice from body margin; rim of orifice turned slightly cephalad at posterior end and meeting a small tooth rising vertically from inside orifice; floor of orifice smooth except for 4–8 flat, sclerotized, toothlike projections in center, directed caudad and arranged in 2 or 3 rows. Operculum cordate, reaching at least to third pair of lobes of lingula. Lobes of lingula well developed, long setae of lingula reaching about to, or just beyond, edge of orifice. Grooves beside orifice and caudal furrow well defined, the latter extending at least to caudal setae.

Inner basal area of legs sclerotized; middle and posterior legs each with 2 large, strong spines about 8–10 μ long and 2–4 smaller ones, and 1 slender seta around 7 μ long. Anterior abdominal spiracles very small but often distinguishable.

TRIALEURODES VARIABILIS (Quaintance)

Aleurodes variabilis Quaintance, 1900, U. S. Dept. Agr., Div. Ent., Tech. Ser. 8: 39–41, illus.

Aleyrodes subgenus *Trialeurodes variabilis* (Quaintance), Cockerell, 1902, Acad. Nat. Sci. Phila. Proc. 54: 283.

Asterochiton variabilis (Quaintance), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.

Trialeurodes variabilis (Quaintance), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi.

Trialeurodes caricae Corbett, 1935, Ann. and Mag. Nat. Hist. (ser. 10) 16: 245–246, illus. (New synonymy.)

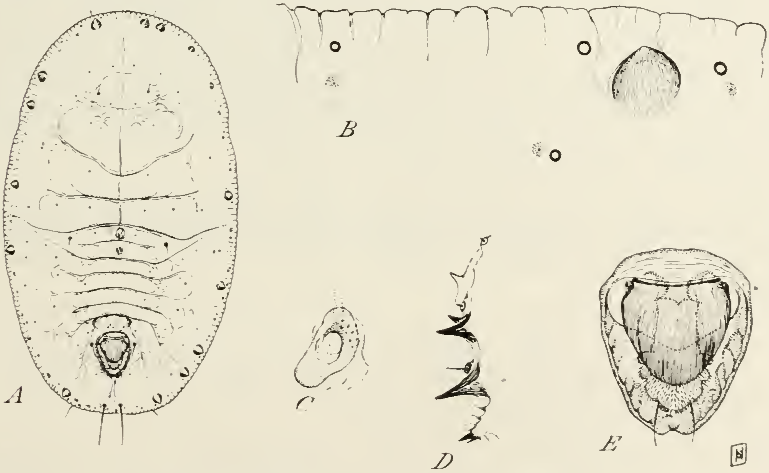

FIGURE 9.—*Trialeurodes variabilis: A*, Outline; *B*, section of margin and submargin; *C*, thoracic spiracle; *D*, part of inner basal area of middle leg; *E*, vasiform orifice.

Trialeurodes caricae was described from a single specimen taken in Trinidad. Although the type was not available to the writer, from the description and illustrations the species appears to be conspecific with *variabilis*. Both species were described from papaw, and *variabilis* is found commonly in Florida and the West Indies.

The prominence of papillae varies exceedingly in *variabilis*, but in the majority of specimens they are degenerate. In an occasional specimen, however, the submarginal ones and a few subdorsal ones are well developed. The abdominal setae usually are short but very rarely are long. Also, though the length of the caudal setae is practically the same in hundreds of specimens, in a few insects at hand from *Manihot* and *Gardenia* the setae are greatly abbreviated. The specimens from *Manihot* demonstrate a range from short to long, but in the few forms from *Gardenia* the setae are either very short or very long. The texture of the leaves of these hosts is quite different from that of *Carica* and doubtless affects the size of the caudal setae. Similar variation is found frequently in some of the groups discussed later, and it may be remarked that in specimens of *vaporariorum* from *Gardenia* the caudal setae tend to be conspicuously shortened.

Characteristic of group. As mounted, 0.50–0.75 mm. long and 0.35–0.45 wide. Thoracic tracheal pore areas usually inevident. Usually none or fewer than 15 submarginal papillae well developed, but occasionally more than 15, or all, well developed, a total of 34–54 indicated; ranging downward in size from 24 μ long and wide, but usually few larger than 18 μ long and wide, uniform or variable in size; situated less than the width of a papilla from body margin; posterior pair about in line with others.

One pair (rarely 2 pores on one half of body and 1 pore on the other half) of submedian disk pores usually present on first abdominal segment. Dorsal papillae usually absent, but if present, near any subdorsal disk pore, similar to submarginal ones in size and shape. A median tuberculate area on first and usually on second abdominal segment, and a pair of slightly tuberculate areas just posterior to pockets. Length of setae about as follows: Anterior marginal, 5 μ; cephalic, 8–10 μ; first abdominal, 8–10 μ or very rarely 40; eighth abdominal, 12–16 μ or very rarely 40 (bases opposite widest part of orifice); caudal, 60–70 μ usually, but sometimes 20 (bases in line with posterior submarginal papillae); posterior marginal, 16 μ. Rim defined across anterior end of vasiform orifice, about 10 μ long; orifice 48–60 μ long and 46–54 wide, its anterior edge around two-thirds width of orifice from posterior suture. Operculum 32–40 μ long and 36–44 wide, its posterior margin moderately curved and reaching to terminal lobe of lingula. Lingula 32–40 μ long and 24–28 wide.

Ventral abdominal setae 20 μ long.

HOSTS.—*Acer mexicanum* A. Gray, *Carica papaya* L. (cotypes and other specimens), *Carica* sp., *Citrus paradisi* Macfad., *C. reticulata* Blanco, *Coccoloba floribunda* (Benth.) Lindau, *Gardenia* sp., *Manihot glaziovii* Muell. Arg.

DISTRIBUTION.—Florida: Coconut Grove, Eau Gallie, Fort Lauderdale, Lake City, Miami (cotypes and other specimens), Orlando, Oviedo, Saint Petersburg, Winter Haven, and unstated localities.

Mexico: Near Manzanillo, State of Colima; Hermosillo and Nogales, State of Sonora; an unknown location.

Costa Rica: Location unknown. Guatemala: Puerto Barrios. Hondures: "Zanomoa." Cuba: Santiago de las Vegas, Vedado. Puerto Rico: Bayamon, Tres Hermanos. Saint Croix: Location unknown.

Redescribed from a quantity of unmounted material and about 500 mounted insects.

TRIALEURODES SIMILIS, new species

Characteristic of group. Mounted specimens 0.55–0.75 mm. long and 0.35–0.45 wide. Body margin often indented by growth against hairs on leaves. Each thoracic tracheal pore area usually marked by narrowness of 3 or 4 marginal crenulations. A total of 40–60 submarginal papillae, all or majority well developed; slightly variable in size, posterior pair usually largest and usually situated anterior to penultimate pair which is in line with others; largest 20 μ long and wide, but usually only 16, majority of others 12–14 μ long and wide; majority situated at least twice the width of a papilla from body margin and from one another.

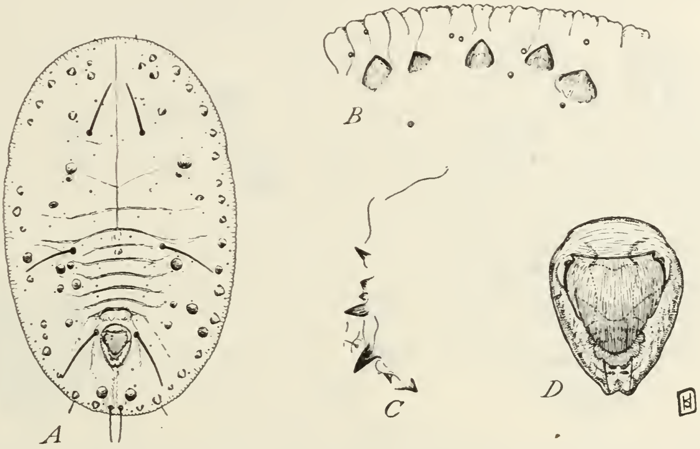

FIGURE 10.—*Trialeurodes similis:* *A,* Outline; *B,* section of margin and submargin; *C,* part of inner basal area of middle leg; *D,* vasiform orifice.

Usually 2 pairs (sometimes 2 pores on one half of body and 1 pore on other half) of submedian disk pores on first abdominal segment. A papilla usually well developed near 1 or 2 subdorsal pores on some cephalothoracic segment, on abdominal segments 3 and 4 and sometimes on 5 or 6; the majority similar in size and shape to submarginal papillae, but the largest ones usually 24 μ long and wide. A median tuberculate area on each of abdominal segments 1 and 2 and a pair of slightly tuberculate areas just posterior to pockets. Length of setae about as follows: Anterior marginal, 5 μ; cephalic, 75–100 μ; first abdominal, 80–100 μ; eighth abdominal, 84–100 μ (bases opposite anterior margin of orifice); caudal, 60–72 μ; posterior marginal, 16 μ. Rim defined across anterior end of vasiform orifice, about 10 μ long; orifice 40–52 μ long and 38–48 wide, its anterior edge about the width of the orifice from posterior suture. Operculum 28–40 μ long and 32–44 wide, its posterior margin rather narrowly curved and reaching to terminal lobe or to tip of lingula. Lingula 24–40 μ long and 22–26 wide.

Ventral abdominal setae 20 μ long.

HOSTS.—*Galactia* sp.?, and an unknown host.

DISTRIBUTION.—Florida: Miami, Sanibel Island.

Described from numerous unmounted and 100 mounted specimens. Holotype and paratypes from *Galactia* sp.?, Sanibel Island, collected by E. A. Back during the summer of 1909; other paratypes taken at Miami by A. L. Quaintance, December 27, 1897.

TRIALEURODES TEPHROSIAE, new species

In *tephrosiae* the length of the first abdominal setae varies more than in any other species observed, being more than 80 μ long in slightly more than half the insects examined and less than 15 μ in the remaining specimens. The length of the operculum also varies unusually though it is long in relatively few cases. As far as determinable, the variation in the setae and operculum is normal, and cannot be correlated with the pubescence of the leaves or the position of the insects on the leaves, and has no distributional significance.

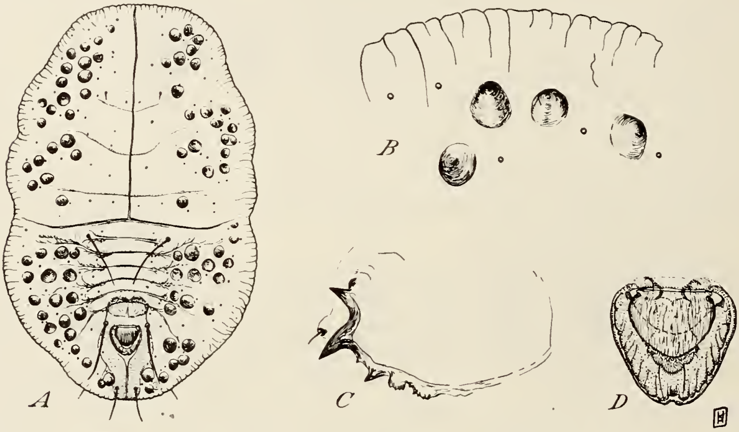

FIGURE 11.—*Trialeurodes tephrosiae: A*, Outline; *B*, section of margin and submargin; *C*, part of inner basal area of middle leg; *D*, vasiform orifice.

Characteristic of group in most respects. A brownish subdorsal stripe often present on each half of body. As mounted, 0.55–0.75 mm. long and 0.40–0.50 wide. Body margin usually strongly indented at various spots by growth against hairs on leaves. Thoracic tracheal pore areas inevident. Submarginal disk pores variable in position, some distad of papillae but as many laterad or mesad in most specimens, located rather close to papillae if mesad or laterad of them. Submarginal papillae broadly conical, nearly regular in position or very irregular owing to indentations in body margin, they, as well as disk pores, often dropping out opposite indentations, sometimes adjacent to dorsal papillae and almost indistinguishable from them, apparently 35–60 present but possibly more; located two to three times the width of a papilla from body margin usually, and almost contiguous or at some distance from one another, the majority pointing vertically; posterior pair usually cephalad of penultimate pair, as large as any and measuring 20–24 μ long and wide; possibly a cephalic pair and 1 or 2 other pairs this large also, the majority 12–16 μ long and wide.

Subdorsal disk pores as stated for the group or 1 or 2 additional ones (these may actually be submarginal) possibly present on any segment, 1 pair of submedian disk pores on first abdominal segment. Papillae well developed near some subdorsal pores, usually near most of them, 1 on each of several segments as large as the largest submarginal ones and the others similar in size and shape to smaller submarginal ones. Area posterior to pockets slightly swollen. Length of setae as follows: Anterior marginal, 5 μ; cephalic, 10–16 μ; first abdominal, 8–12 or 80–100 μ; eighth abdominal, 65–100 μ (bases opposite anterior margin of orifice and close to seventh abdominal suture); caudal, 50–70 μ (bases in line with penultimate papillae); posterior marginal, 20 μ. Rim not defined across anterior end of vasiform orifice; orifice 40–48 μ long and wide, located its width from posterior suture. Operculum 24–30 μ long and 36–40 wide, its posterior margin rather broadly curved and reaching to third pair of lobes of lingula usually, but sometimes to terminal lobe. Lingula 26–28 μ long and 22–24 wide.

Ventral abdominal setae 32 μ long.

HOSTS.—*Tephrosia arcuata* (Rydb.) Standl., *T. heydeana* (Rydb.) Standl., *T. langlassei* Micheli, *Tephrosia* sp.

DISTRIBUTION.—Mexico: Maria Madre Island and vicinity of Acaponeta, State of Nayarit; between Las Palmas and Ixtapa, and at San Sebastian, State of Jalisco; "Lodiego."

Costa Rica: Province of Guanacaste. El Salvador: Between San Martin and Laguna de Ilopango, Department of San Salvador; vicinity of San Vicente, Department of San Vicente. Panama: Between Hato del Jobo and Cerro Vaca, Province of Chiriqui.

Described from numerous unmounted and 46 mounted specimens. All but one lot of specimens removed from plant material in the United States National Herbarium. The plant material was collected as follows: *T. arcuata*, vicinity of Acaponeta, J. N. Rose, P. C. Standley, and P. G. Russell, April 9, 1910 (holotype and paratypes); *T. arcuata*, Acaponeta, F. H. Lamb, February 1895; *T. arcuata*, between Las Palmas and Ixtapa, E. W. Nelson, March 31, 1897; *T. arcuata*, Maria Madre Island, T. S. Maltby, May 3, 1897; *T. heydeana*, Guanacaste, Oton Jiminez L., February 1912; *T. heydeana*, near San Vicente, P. C. Standley, March 2–11, 1922, and San Martin to Laguna de Ilopango, April 1, 1922; *T. heydeana*, between Hato del Jobo and Cerro Vaca, H. Pittier, December 25–28, 1911; *Tephrosia* sp., "Lodiego," J. Monell, October 24, 1878.

HUTCHINGSI GROUP

Six species known only from, and probably indigenous to, the Pacific Coast area of North America make up the Hutchingsi Group. Although the species *hutchingsi*, *madroni*, *corollis*, *bemisae*, *tentaculatus*, and *merlini* have a number of characteristics which appear to unite them to one another more closely than to other known members of the genus, they are extremely individualistic and differ strikingly. Also, *tentaculatus* is a border species and possibly should be included in a distinct group. The Hutchingsi Group appears to be intermediate between the Floridensis and the Vaporariorum Groups. The undeveloped condition of submarginal papillae encountered in some other groups is met with here in only one species, and relatively little variation has been observed in length of setae. The species of the group appear to be relatively stable.

Although the species occur mainly on glabrous leaves, some are found on minutely pubescent ones. None are known to be injurious, and *merlini* is the only one known to occur abundantly.

The following characterization applies to the group:

Abundant flocculent secretion present or absent. Dorsal and ventral layers of wax brittle, not adhering to derm. Dorsum usually brown or black and rather thick (except in *tentaculatus*), ventral surface slightly lighter in color, slightly thinner, and less sclerotized than dorsal surface.

Marginal crenulations well marked, broad (except in *tentaculatus*), and nearly uniform in width; submarginal ridges strong, extending to papillae. Submarginal papillae usually directed laterally but a few sometimes pointing diagonally, lateral portions of papillae and ventral part of their distal ends tending to be more heavily sclerotized than the upper part. Submarginal porettes usually well defined, situated in bases of papillae. Apparently 8 pairs of submarginal setal bases on cephalothorax and 7 pairs on abdomen, usually located less than the width of a papilla mesad of papillae, usually without distinguishable setae.

Dorsal porettes usually well defined near majority of dorsal disk pores, often a small, membranous area surrounding them if papillae are not developed. Transverse molting suture curved posteriorly from its center but recurved and reaching submarginal papillae nearly opposite its midpoint (except possibly in *corollis*). Eight segments apparent in median area of abdomen. Pockets large, no more than half the width of a pocket apart. Anterior marginal and cephalic setae present, all slender and tapering; the eighth abdominal pair situated anterior to widest part of orifice and usually about midway between orifice and seventh abdominal suture; bases of caudal pair in line with or distad of submarginal papillae and the setae not reaching much beyond body margin. Vasiform orifice cordate or elongate cordate, its anterior end about the width of the orifice from posterior suture (except in *merlini*) and its posterior end one and one-quarter to one and one-half times the length of the orifice from the body margin; rim absent from anterior end but prominent elsewhere, usually a notch at posterior end and a prominent tooth in notch; orifice somewhat sclerotized and its bottom usually rugose. Operculum somewhat cordate, occupying less than two-thirds of orifice (except in *madroni*), and reaching no further than to the third pair of lobes of the lingula, its posterior margin usually moderately curved. Lobes of lingula well developed, long setae of lingula extending to or just beyond edge of orifice. Grooves beside orifice well defined, caudal furrow usually narrow and extending to submarginal papillae.

Inner basal area of anterior and middle legs slightly sclerotized and the latter slightly sculptured; a seta about 5 μ long on each middle and posterior leg. Anterior abdominal spiracles distinct. Ventral abdominal setae 24–28 μ long.

TRIALEURODES HUTCHINGSI (Bemis)

Aleyrodes hutchingsi Bemis, 1904, U. S. Natl. Mus. Proc. 27: 532–534, illus.
Asterochiton hutchingsi (Bemis), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.
Trialeurodes hutchingsi (Bemis), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi.

In unmounted material of *hutchingsi* there are nearly as many insects on the upper as on the lower surface of the leaves. There is, however, no appreciable difference in the size of the vasiform orifice, the operculum, and the lingula in specimens from the two surfaces. Neither does the position of the insect on the leaf, nor the hairiness of the leaf, appear to be responsible for the variation in the length of the caudal setae.

With the characters of the group. A little white powdery wax sometimes present on dorsum. Very dark brown or black. Mounted specimens 0.80–1 mm. long and 0.50–0.65 wide. Dorsum somewhat sculptured. Around 9 marginal crenulations in 100 μ; tracheal pore areas inevident. A total of 220–345 submarginal papillae arranged in a narrow, double, or triple unbroken row, nearly or actually contiguous; apices of outer papillae about the length of a papilla from body margin; broadly conical, 18–24 μ long and 12–20 wide. Submarginal disk pores usually in or contiguous to bases of papillae, rarely somewhat mesad or laterad of them.

Pairs of dorsal disk pores usually arranged as follows: One subdorsal on each thoracic segment; 1 submedian on each cephalothoracic segment and on each of abdominal segments 3–7, 2 submedian on first abdominal segment. Approximate length of setae as follows: Anterior marginal, 8 μ; cephalic, 24 μ; first abdominal, 28 μ; eighth abdominal, 28 μ; caudal, 14–36 μ (distad of, but close to, papillae); posterior marginal, 28 μ. Vasiform orifice cordate, 72–76 μ long and 60–68 wide. Operculum broadly curved posteriorly, reaching to second pair of lobes of lingula, 40–44 μ long and 52–56 wide. Lingula 52–56 μ long and 28 wide.

Hosts.—*Arctostaphylos patula* Greene, *Arctostaphylos* sp. (cotypes).

Distribution.—California: Yosemite Valley (cotypes and other specimens).

Redescribed from a few unmounted and 19 mounted insects. Some cotypes loaned by G. F. Ferris.

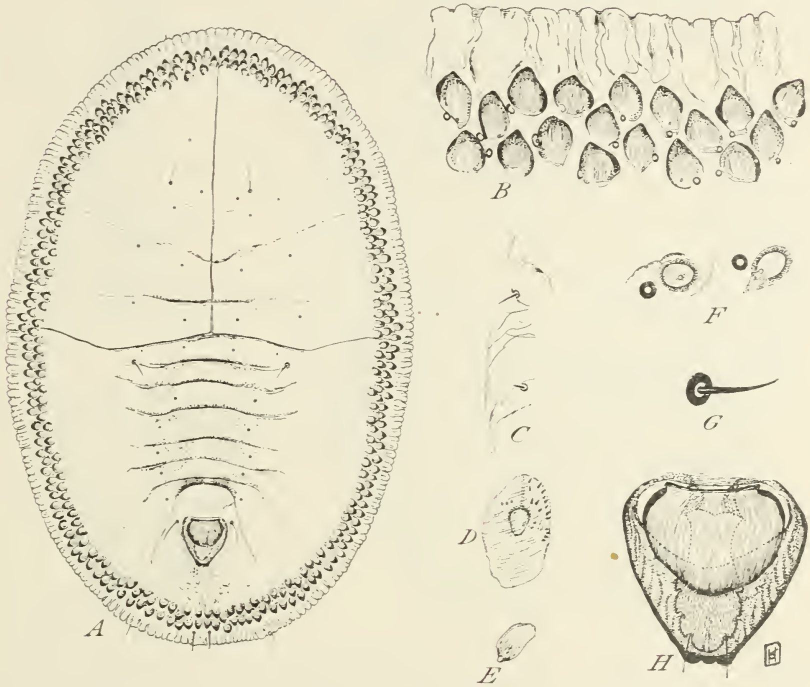

Figure 12.—*Trialeurodes hutchingsi: A,* Outline, not showing color or sculpturing; *B,* section of margin and submargin; *C,* part of inner basal area of middle leg; *D,* thoracic spiracle; *E,* anterior abdominal spiracle; *F,* section of dorsum showing disk pores, porettes, and differentiated area; *G,* cephalic seta; *H,* vasiform orifice.

TRIALEURODES MADRONI (Bemis)

Aleyrodes madroni Bemis, 1904, U. S. Natl. Mus. Proc. 27: 507–508, illus.
Asterochiton madroni (Bemis), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.
Trialeurodes madroni (Bemis), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi.
Trialeurodes californiensis Sampson, 1945, Pan-Pacific Ent. 21: 61–62, illus. (New synonymy.)

The holotype and paratype specimens of *californiensis* are entirely typical of *madroni.*

According to Bemis the unmounted insects show "* * * dorsum covered with thinly scattered, minute, semitransparent granules of white wax * * * Dorsum of case shining black * * *"

With the characters of the group. Dorsum somewhat sculptured. Mounted insects 1–1.10 mm. long and 0.70–0.80 wide. Around 9 marginal crenulations in 100 μ; tracheal pore areas inevident. Submarginal papillae in a single, rather irregular, unbroken row, 153–206 present, nearly or actually contiguous, elongate conical, 18–22 μ long and 12–16 wide, apices rather blunt, and about the width of a papilla from body margin. Submarginal disk pores sometimes in, but usually slightly mesad of, bases of papillae.

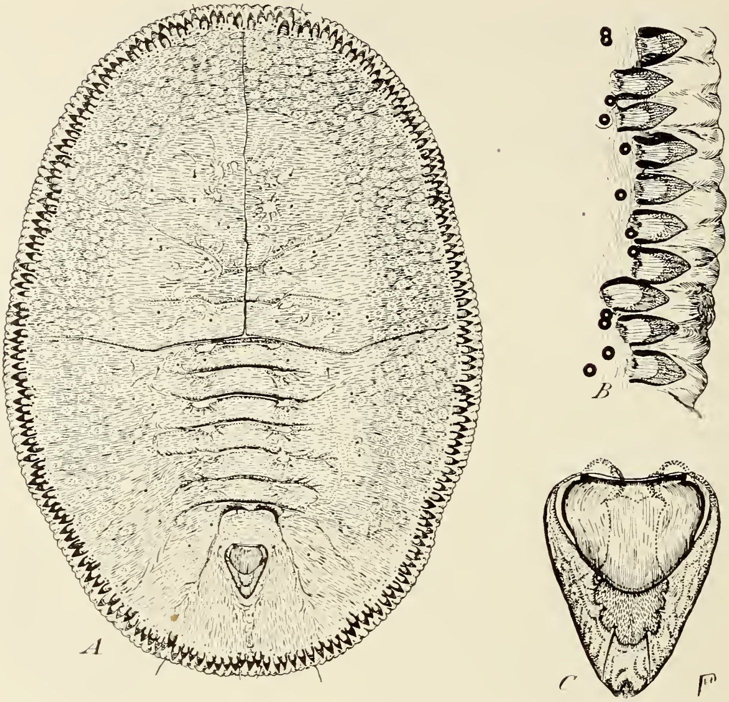

FIGURE 13.—*Trialeurodes madroni: A*, Outline; *B*, section of margin and submargin; *C*, vasiform orifice.

Pairs of dorsal disk pores arranged about as follows: One subdorsal (sometimes 2 on some segments) on each body segment except cephalic, and abdominal 1, 2, and 8; 2 (sometimes 3) submedian on each thoracic and first abdominal segment and 1 submedian on cephalic segment and on each of abdominal segments 3–7; sometimes a very small, almost flat papilla present near some pore. Length of setae about as follows: Anterior marginal, 8 μ; cephalic, 12 μ; first abdominal, 12–16 μ; eighth abdominal, 12–16 μ; caudal, 16–20 μ (bases underneath tips of papillae); posterior marginal, 28 μ. Vasiform orifice elongate cordate, 72–80 μ long and 62–64 wide. Operculum rather broadly curved posteriorly, 44–48 μ long and 52–56 wide, reaching about to middle of second pair of lobes of lingula. Lingula 56–60 μ long and 28 wide.

HOSTS.—*Arbutus menziesii* Pursh (cotypes of *madroni* and other specimens), *Quercus* sp. (holotype and paratypes of *californiensis*).

DISTRIBUTION.—California: Antioch (holotype and paratypes of *californiensis*), Berkeley, Stanford University (cotypes of *madroni*).

Redescribed from 32 mounted specimens.

The holotype and 2 paratypes of *californiensis* were loaned by G. F. Ferris.

TRIALEURODES COROLLIS (Penny), NEW COMBINATION

Asterochiton corollis Penny, 1922, Jour. Ent. and Zool. 14; 26–28, illus.

The appearance of unmounted insects is, according to Penny,

> * * * color dark brown. The wax secretion of the dorsum * * * consists of * * * a continuous marginal fringe * * * the rods of which are short and loosely joined, projecting directly toward the leaf to about one-half

of the distance from the margin to the leaf. Second, a series extending continuously around the case just within the margin. The rods of this system are long, white, and closely coalesced at their bases and extend upward for the greater part of their lengths then outward over the case, separating into ribbon-like structures at their extremities. Third, a series of short, thick rods arranged in groups which arise mesad of the second system and which project toward the center of the case. In addition to the dorsal wax the pupa case secretes a high vertical fringe of wax on which the case rests. * * *

To this description by Penny, the writer adds the following:

Mounted insect characteristic of the group in most respects. About 1 mm. long and 0.80 wide. Dorsum somewhat sculptured. Around 8 marginal crenulations in 100 μ; each thoracic tracheal pore area marked by 2 or 3 shallow indentations in 1 or 2 marginal crenulations and abdominal one indicated by narrowness of around 5 crenulations. Approximately 150 submarginal papillae arranged in a single row, which is broken at the caudal furrow, the majority of them nearly touching at base, their distal ends drawn out and about twice the length of a papilla from body margin; papillae elongate, 24–30 μ long and 12–16 wide. Nearly all submarginal disk pores distad of papillae, about in line with their tips but an occasional one mesad of them.

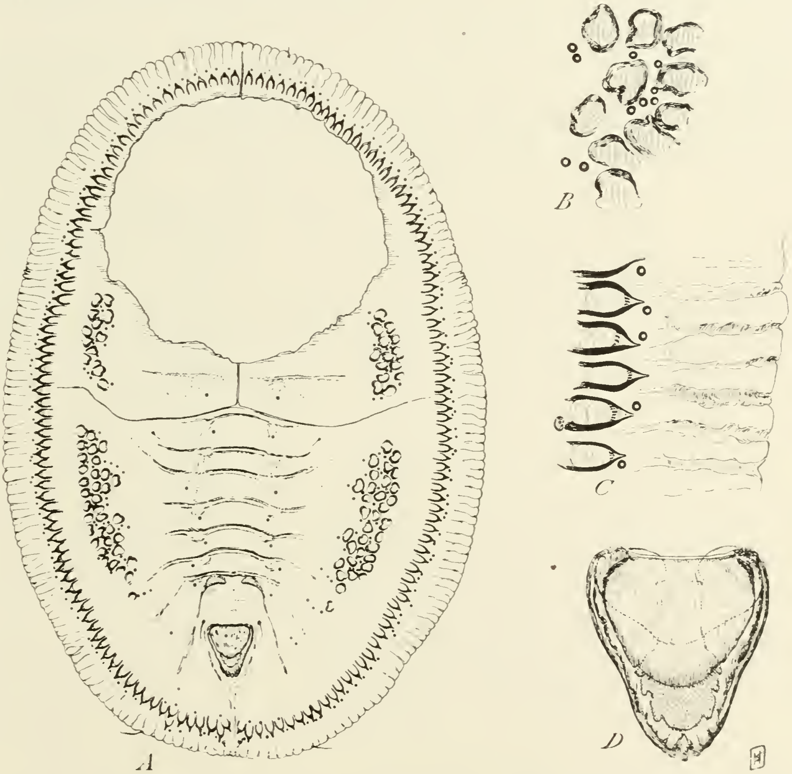

FIGURE 14.—*Trialeurodes corollis:* A, Outline; B, dorsal papillae and disk pores; C, section of margin and submargin; D, vasiform orifice.

Dorsal papillae in 6 subdorsal groups according to original description (anterior 2 destroyed by parasite escape hole in specimen at hand) of which 4 are cephalothoracic and 2 abdominal, 13–15 in each of cephalothoracic groups and 33–36 in each abdominal group; papillae unusual in shape, only slightly elevated from derm and almost flat, their outer edges sclerotized but the rest membranous, irregular in outline, around 16 by 12–24 μ; their disk pores variable but most of them mesad of papillae; porettes in edges of papillae. Also 2 pairs of subdorsal disk pores (no papillae associated with them) on each of abdominal segments 6 and 7, and 1 submedian pair on metathoracic and on each of abdominal segments 1 and 3–7 (any others on cephalothorax destroyed by parasite escape hole). Length of setae about as follows: Anterior marginal, 4 μ; cephalic, destroyed; first abdominal, 16 μ; eighth abdominal, 25 μ; caudal (bases underneath tips of papillae), 4 μ; posterior marginal, 36 μ. Transverse molting suture terminating farther cephalad than is typical for the group in available specimen, its ends opposite midpoint between it and mesometathoracic suture. Visiform orifice elongate cordate, 80 μ long and 64 wide, characteristics of its bottom indeterminable. Operculum moderately curved posteriorly, 50 μ long and 60 wide, reaching about to center of second pair of lobes of lingula. Lingula 60 μ long and 32 wide, its long setae indeterminable in specimen at hand.

Most characters of ventral surface indistinguishable in available specimen but characteristic of the group as far as determinable.

HOST.—*Arctostaphylos manzanita* Parry (cotype).

DISTRIBUTION.—California: Pine Hills (San Diego County) (cotype).

Redescribed from 1 mounted specimen loaned by D. D. Penny.

TRIALEURODES BEMISAE, new species

Aleyrodes tentaculatus Bemis, 1904, U. S. Natl. Mus. Proc. 27: 494–496, illus., in part.

Asterochiton tentaculatus (Bemis), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105, in part.

Trialeurodes tentaculatus (Bemis), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27; xi, in part.

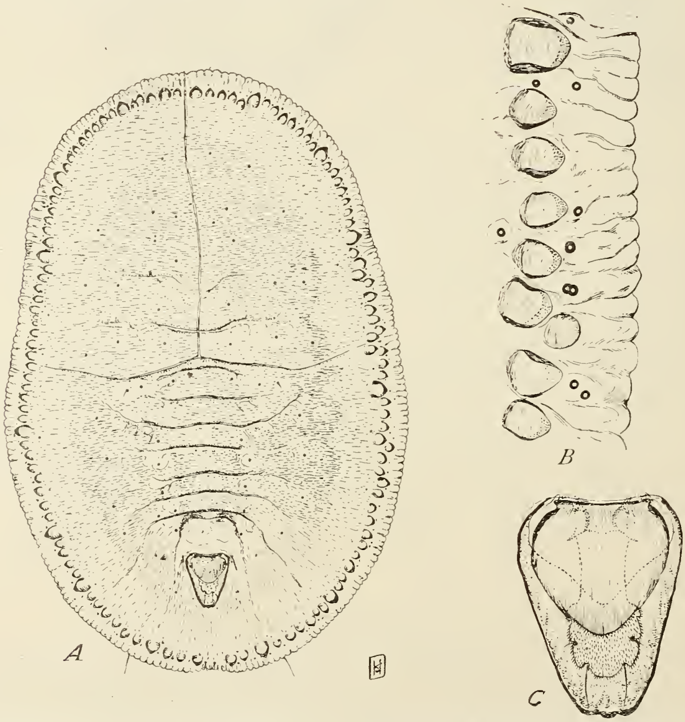

FIGURE 15.—*Trialeurodes bemisae: A*, Outline; *B*, section of margin and submargin; *C*, vasiform orifice.

Some of the insects described as *tentaculatus* by Bemis belong to the species here named *bemisae*. Plate XXXI, figure 26, of Bemis, rather certainly illustrates the latter rather than *tentaculatus*. Although the two species are rather similar, they are amply distinct.

Characteristic of the group. Light brown to medium brown. Mounted insects 0.90–1 mm. long and 0.55–0.75 wide. Derm somewhat sculptured. Around 10 marginal crenulations in 100 μ; each tracheal pore area weakly marked by the narrowness of 3–6 crenulations. Submarginal papillae in a single row which is broken at the caudal setae, 96–125 present and all well developed or some indicated by a slight protuberance or a slightly differentiated area in derm; distinguishable papillae 6–24 μ long and 8–26 wide, 14–18 definitely larger papillae usually interspersed with smaller ones at fairly uniform intervals; tending to be somewhat broadly conical, their distal ends blunt; when well developed the greatest interval between them is around half the width of an average papilla, and their tips are at least the length of an average papilla from the body margin. Submarginal disk pores situated about in line with tips of papillae for the most part, but occasionally one laterad of or in the base of a papilla.

Pairs of dorsal disk pores arranged about as follows: Two subdorsal on each cephalothoracic (often only 1 on prothoracic) segment and 1 subdorsal on each of abdominal segments 3–8; 1 submedian on each cephalothoracic segment and on all abdominal segments except 2 and 8. Length of setae about as follows: Anterior marginal, 2 μ; cephalic, 6 μ; first abdominal, 8 μ; eighth abdominal (nearer to orifice than to seventh abdominal suture), 12–16 μ; caudal, 8 μ (their bases in line with outer part of papillae); posterior marginal, 32–36 μ. Vasiform orifice elongate cordate, 80–88 μ long and 64–68 wide, its bottom rugose at posterior end. Operculum narrowly curved posteriorly, 50–56 μ long and 56–60 wide, extending to third pair of lobes of lingula. Lingula 60–64 μ long and 30–34 wide.

HOSTS.—*Arbutus menziesii* Pursh, *Ceanothus thyrsiflorus* Esch., *Photinia arbutifolia* (Ait.) Lindl., *Quercus agrifolia* Nées.

DISTRIBUTION.—California: Berkeley, Los Angeles, Stanford University.

Described from 13 mounted specimens collected as follows: *Arbutus*, Berkeley, D. D. Penny, March 1, 1917; *Ceanothus*, Los Angeles, R. H. Smith, November 12, 1943; *Photinia*, Berkeley, P. J. Timberlake, April 19, 1911; *Quercus*, Stanford University, Florence E. Bemis, January 30, 1902 (holotype).

TRIALEURODES TENTACULATUS (Bemis)

Aleyrodes tentaculatus Bemis, 1904, U. S. Natl. Mus. Proc. 27: 494–496, illus., in part.

Asterochiton tentaculatus (Bemis), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105, in part.

Trialeurodes tentaculatus (Bemis), Quaintance and Baker, 1915, U. S. Dept. Agr. Bur. Ent., Tech. Ser. 27: xi, in part.

As has been stated on page 39, some of the insects described and illustrated by Bemis under the name *tentaculatus* are referable to *bemisae*. The greater part of the original description and figures apparently refer to the species here portrayed, however.

Trialeurodes tentaculatus differs from the other species of this group in the lighter color and more membranous quality of the dorsal derm, the narrowness of the marginal crenulations, and the direction in which the submarginal papillae point. In other characters, however, it is similar to the other species, and it appears to be rather closely allied to *bemisae*. On the basis of present knowledge of the genus, its inclusion here is believed to show its relationship more

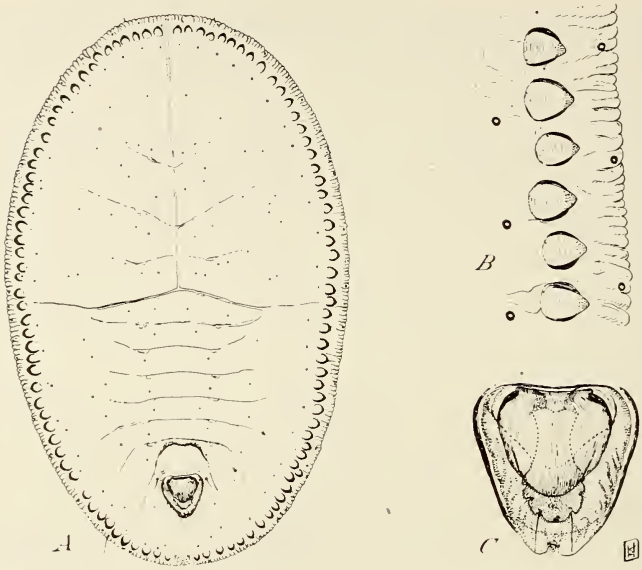

FIGURE 16.—*Trialeurodes tentaculatus*: *A*, Outline; *B*, section of margin and submargin; *C*, vasiform orifice.

clearly than would its elimination. Study of closely related species may show, however, that it is representative of a distinct group.

Characteristic of the group in most respects but not entirely so. Yellow or whitish except for the brownish vasiform orifice. As mounted, 0.80–0.95 mm. long and 0.50–0.60 wide. Dorsum somewhat sclerotized, slightly sculptured, particularly in sudorsum. Marginal crenulations unusually narrow for the group, about 18 in 100 μ; submarginal ridges rather weak for this group and often not reaching papillae; each tracheal pore area usually plainly marked by the narrowness of 3 or 4 crenulations and fine sculpturing of submarginal ridges, the abdominal one being particularly conspicuous. Submarginal papillae in a single row which is broken at caudal setae, a total of 90–130, usually less than half the width of one apart and rarely contiguous, 16–20 μ long and 12–16 wide, rather roundly conical, the inner ends plainly demarked from derm, the apices rather blunt and directed laterally or diagonally, and some anterior ones almost vertically, about the length of a papilla from body margin. Slightly more than half of submarginal disk pores located about the width of a papilla mesad of papillae, but the remainder distad of them and the majority of these close to body margin. Pairs of dorsal disk pores arranged about as follows: Anterior 3 cephalothoracic segments, each 2–4 subdorsal and 1–3 submedian; metathoracic segment, 2 subdorsal and 4 submedian; first abdominal, 2–3 submedian; second through seventh abdominal, each 1 submedian; third through eighth, each 1 or sometimes 2 subdorsal. Length of setae about as follows: Anterior marginal, 4 μ; cephalic, 5 μ; first abdominal, absent; eighth abdominal, 28–32 μ; caudal (in line with bases of papillae), 12–16 μ; posterior marginal, 20 μ. Vasiform orifice somewhat cordate but unusually broad at apex, 68 μ long and 64 wide, bottom slightly rugose near sides, smooth in center. Operculum 40–44 μ long and 48 wide, extending to third pair of lobes of lingula. Lingula 48 μ long and 28 wide.

HOST.—*Quercus agrifolia* Nées (cotypes and other specimens).

DISTRIBUTION.—California: Fresno, Puente Hills, Stanford University (cotypes), Whittier.

Redescribed from a few unmounted and 27 mounted insects.

TRIALEURODES MERLINI (Bemis)

Aleyrodes merlini Bemis, 1904, U. S. Natl. Mus. Proc. 27: 512–514, illus.
Asterochiton merlini (Bemis), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.
Trialeurodes merlini (Bemis), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi.

Superficially *merlini* does not resemble the other members of the Hutchingsi Group owing to the unusual shape and arrangement of the papillae. It is charcteristic of the group in most respects, however.

A copious secretion of white, fibrous, waxy material extending outward from submargin, individual threads of the mass sometimes apparent but entire mass usually matted, filaments one to four times as long as width of body; a little material similar to the above but without long filaments on dorsum, apparently replacing thin transparent layer of wax found in other species; submarginal glassy wax rods not observed, apparently replaced by whitish waxy filaments. Palisade and ventral layer of wax typical of the genus.

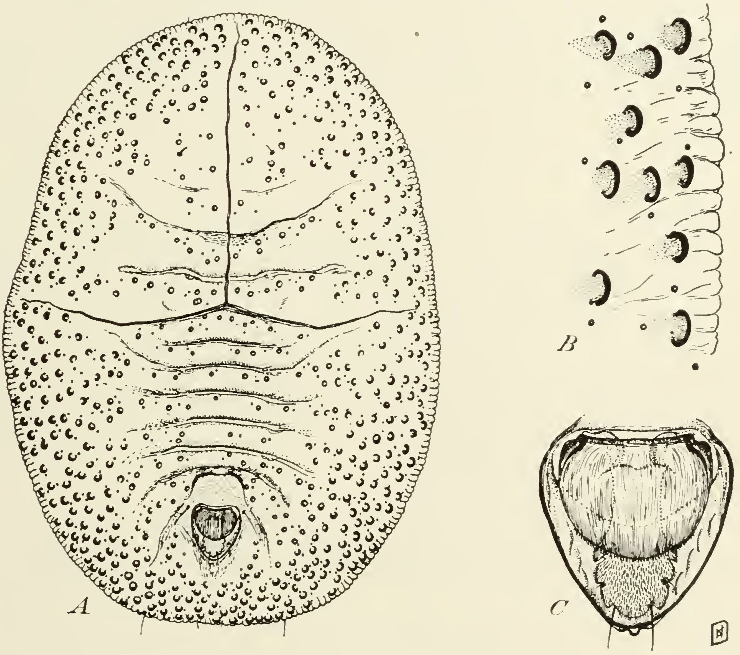

FIGURE 17.—*Trialeurodes merlini:* *A*, Outline; *B*, section of margin and submargin; *C*, vasiform orifice.

Derm light or medium brown, not sculptured. Mounted insects 0.90–1 mm. long and 0.65–0.75 wide. Approximately 10 marginal crenulations in 100 μ; tracheal pore areas inevident. Papillae distributed over dorsum, without a submarginal row differentiated from dorsal ones, tending toward a segmental arrangement which is readily apparent mesad of ends of sutures but less definite elsewhere; usually present across entire body except for median area of seventh and eighth (anterior to vasiform orifice) abdominal segments; outer papillae about the width of one from body margin, posterior ones closest together and a half to more than the width of a papilla apart; all papillae short and broad, curved, knoblike, and somewhat crescent-shaped; outer ones largest, around 8 μ long and 16 wide, gradually decreasing in size toward center of body to 2–4 μ long and 4–8 wide. Disk pores situated mesad, laterad, or distad of inner papillae, but only an occasional one distad of outer papillae, other disk pores absent. Porettes in bases or sides of papillae. Posterior pair of submarginal setal bases located distad of outer papillae and bearing setae about 4 μ long, other setal bases mesad of outer papillae, placed irregularly, setae barely, or not, distinguishable. Length of setae about as follows: Anterior marginal, 4 μ; cephalic, 12 μ; first abdominal, absent; eighth abdominal, 32–36 μ; caudal (bases close to body margin), 12 μ; posterior marginal, 30 μ. Anterior margin of vasiform orifice only about two-thirds width of orifice from posterior suture, orifice cordate, 76–80 μ long and 72–76 wide, its bottom rugose in center, notch and tooth at posterior end small or absent. Operculum broadly curved posteriorly, 44–48 μ long and 60 wide, extending to second pair of lobes of lingula. Lingula 60 μ long and 28-32 wide, its long setae reaching outside orifice. Grooves beside orifice running into a broad depressed area which extends to papillae.

HOSTS.—*Arbutus menziesii* Pursh (cotypes), *Arbutus* sp., *Arctostaphylos glauca* Lindl., *A. manzanita* Parry, *A. patula* Greene, *A pringlei* Parry, and *Arctostaphylos* sp.

DISTRIBUTION.—British Columbia. Washington: Seattle. California: Berkeley, Chico, Colfax, Kelseyville, Kings Mountain (Santa Clara County) (cotypes), Mount Diablo (Eldorado County), Red Bluff, San Diego, San Jacinto Mountains, near Seneca, Strawberry Valley.

Redescribed from a few unmounted and approximately 285 mounted specimens.

VAPORARIORUM GROUP

Six closely related species make up the Vaporariorum Group, namely, *vaporariorum*, *varia*, *glacialis*, *drewsi*, *diminutis*, and *notata*. The unit is rather closely related to the Hutchingsi Group. The members of the group are plastic and exhibit conspicuous variation which in most cases can be correlated with the physical properties of the leaves the insects inhabit. The original home of most of these species may well have been southwestern North America, but *notata* is known only from the eastern part of the United States. Although the known distribution of most of the species is limited, *vaporariorum* is widespread; and it is the only member of the group which is recognized as a pest of major importance.

The group may be characterized as follows:

Flocculent secretions absent. Vertical palisade of wax practically uniform in height except in *diminutis*. Dorsal and ventral layers of wax brittle, easily separable from derm. Derm nearly or entirely colorless, thin and membranous with exception of papillae.

Marginal crenulations and submarginal ridges distinct but weak, nearly uniform in width and usually about 12 in 100 μ; thoracic tracheal pore areas usually evident, abdominal one distinct. Submarginal papillae usually in a single row which is interrupted at caudal setae, if well developed somewhat conical and rather uniformly sclerotized, at least some of them usually directed vertically. Majority of submarginal disk pores distad of papillae but a few usually mesad or laterad. Submarginal porettes in bases of papillae, usually distinct but inconspicuous. Apparently 8 pairs of submarginal setal bases on cephalothorax and 7 pairs on abdomen, usually all but posterior pair slightly mesad of or in line with papillae except in *varia;* posterior pair usually distad of papillae and bearing distinguishable setae.

Pairs of dorsal disk pores usually arranged about as follows (additional ones present in *glacialis*): Two subdorsal on each cephalothoracic segment and on abdominal segment 3 and sometimes on 4 and 5, and usually 1 subdorsal on each of abdominal segments 5–8; 2 submedian on each thoracic (sometimes 1 on prothoracic segment) and on first abdominal segment, 1 submedian on cephalic segment and on each of abdominal segments 3–7. Dorsal porettes usually evident, at bases of papillae if the latter are well developed, a small membranous area often surrounding some porettes if papillae are absent. Papillae sometimes poorly developed but usually well developed, somewhat conical, and rather uniformly sclerotized. Transverse molting suture curved slightly posteriorly from its center and recurved or not, terminating nearly opposite its midpoint. Eight segments evident in median area of abdomen. Pockets large, usually no more than half the width of a pocket apart. Anterior marginal and cephalic setae present, all setae slender and tapering; eighth abdominal pair situated anterior to widest part of orifice and usually midway between orifice and nearest suture; bases of caudal pair usually in line with outer submarginal papillae, the setae usually extending well beyond body margin. Vasiform orifice cordate, its anterior end usually located about the width of the orifice from seventh abdominal suture and its posterior end one and one-fourth to one and one-half times length of orifice from body margin; its rim not defined across anterior end but pronounced posteriorly and a notch at tip, a prominent tooth in notch, and a large, peglike tooth at end of orifice (except in *diminutis*); center of bottom of orifice with a few flat, sclerotized, toothlike projections directed caudad. Operculum cordate, its posterior margin moderately curved, reaching to third pair of lobes of lingula (covering entire lingula in *diminutis*). Lobes of lingula well developed, long setae of lingula usually extending just beyond edge of orifice. Grooves beside orifice and caudal furrow well defined, except in *diminutis*, the latter usually extending to caudal setae.

Inner basal area of anterior and middle legs slightly sclerotized and this area of middle legs usually slightly sculptured; a seta 5–8 μ long on inner basal area of each middle and posterior leg. Anterior abdominal spiracles well defined.

TRIALEURODES VAPORARIORUM (Westwood)

Aleyrodes vaporariorum Westwood, 1856, Gard. Chron., p. 852, illus.; Cockerell, 1902, Acad. Nat. Sci. Phila. Proc. 54: 282.

Asterochiton vaporariorum (Westwood), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 104–105, illus.; Lloyd, 1922, Ann. Appl. Biol. 9: 1–32, illus.; Laing, *in* Lloyd, 1922, Ann. Appl. Biol. 9: 15–16.

Trialeurodes vaporariorum (Westwood), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi; Baker and Moles, 1921, Rev. Chilena de Hist. Nat. 25: 645, illus., in part.

Asterochiton lecanioides Maskell, 1879, New Zeal. Inst. Trans. and Proc. (1878) 11: 215–216, illus., in part; Maskell, 1890, New Zeal. Inst. Trans. and Proc. (n. s. 5, 1889) 22: 175–176.

Aleyrodes lecanioides (Maskell), Cockerell, 1902, Acad. Nat. Sci. Phila. Proc. 54: 281.

Aleyrodes (*Asterochiton*) *lecanioides* (Maskell), Kirkaldy, 1907, Hawaii Bd. Commrs. Agr. and Forestry, Div. Ent. Bul. 2: 44; Quaintance, 1908, Homoptera, Fam. Aleyrodidae, *in* Wytsman, Genera Insectorum, fasc. 87, p. 6.

Aleurodes papillifer Maskell, 1890, New Zeal. Inst. Trans. and Proc. (n. s. 5, 1889) 22: 173, 176, illus.; Maskell, 1896, New Zeal. Inst. Trans. and Proc. (n. s. 11, 1895) 28: 438.

Aleurodes nicotianae Maskell, 1896, New Zeal. Inst. Trans. and Proc. (n. s. 11, 1895) 28: 436–437, illus.; Cockerell, 1902, Soc. Cient. "Antonio Alzate" Mem. 18: 205–206.

Aleyrodes glacialis Bemis, 1904, U. S. Natl. Mus. Proc. 27: 518–519, in part.

Asterochiton glacialis (Bemis), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105, in part.

Trialeurodes glacialis (Bemis), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi, in part.

Aleyrodes sonchi Kotinsky, 1907, Hawaii Bd. Commrs. Agr. and Forestry, Div. Ent. Bul. 2: 97–98, illus.

Asterochiton sonchi (Kotinsky), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105; Lloyd, 1922, Ann. Appl. Biol. 9: 15–16; Laing, *in* Lloyd, 1922, Ann. Appl. Biol. 9: 15–16.

Trialeurodes sonchi (Kotinsky), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi; Trehan, 1940, Roy. Ent. Soc., London, Trans. 90: 607–608, illus.

Trialeurodes mossopi Corbett, 1935, Stylops 4: 9–10, illus.; Corbett, 1936, Roy. Ent. Soc., London, Proc., Ser. B, Taxonomy 5: 19–20, illus. (New synonymy.)

Trialeurodes natalensis Corbett, 1936, Roy. Ent. Soc., London, Proc., Ser. B, Taxonomy 5: 18–19, illus. (New synonymy.)
Trialeurodes sesbaniae Corbett, 1936, Roy. Ent. Soc., London, Proc., Ser. B, Taxonomy 5: 19, illus. (New synonymy.)

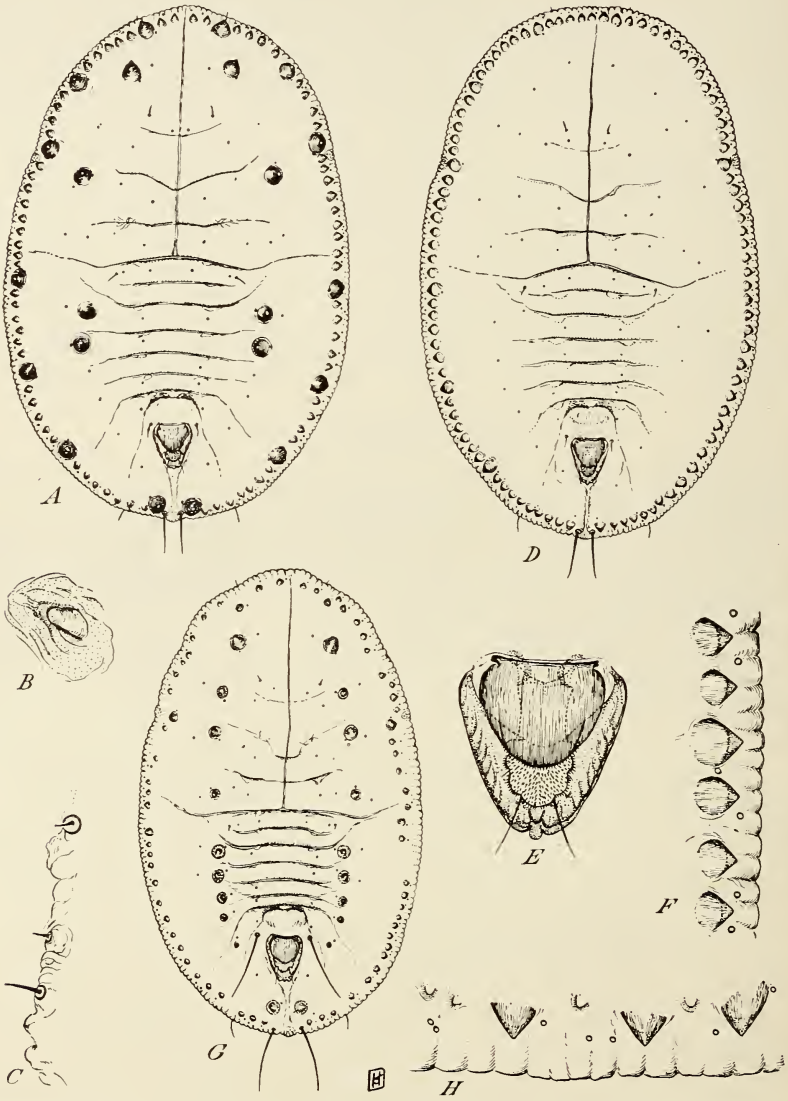

FIGURE 18.—*Trialeurodes vaporariorum:* *A*, Outline, specimen from moderately hairy leaf; *B*, same, thoracic spiracle; *C*, same, part of inner basal area of middle leg; *D*, outline of specimen from smooth leaf; *E*, same, vasiform orifice; *F*, same, section of margin and submargin; *G*, outline of specimen from very hairy leaf; *H*, section of margin and submargin of a specimen from a smooth, tough leaf showing degenerate papillae and greater width of marginal crenulations.

In 1879 Maskell described and named the species *lecanioides* but in 1890 stated that *lecanioides* consisted of two species and he described them under the names *papillifer* and *simplex*. He presumably used the same specimens in describing *papillifer* and *simplex* that he had used in describing *lecanioides*, though this point is not positively determinable. In 1902 Cockerell indicated that *papillifer* was a synonym of *lecanioides*, but recognized *simplex* as a valid species, and cotype specimens of *simplex* before the writer are generically distinct from *papillifer*. Quaintance and Baker (1914) synonymized both *lecanioides* and *nicotianae* with *vaporariorum*. Baker and Moles also listed *sonchi* as a synonym of *vaporariorum*, though Laing, Lloyd, and Trehan subsequently recognized it as a valid species. Cotype specimens of *papillifer*, *nicotianae*, and *sonchi* have been examined by the writer, and in her opinion these types are conspecific with *vaporariorum*.

A small part of the description of *glacialis* refers to specimens actually belonging to *vaporariorum*, and several specimens labeled "cotype of *glacialis*" actually belong to the older species.

Type specimens of *mossopi*, *natalensis*, and *sesbaniae* were not available to the writer. From their descriptions and illustrations, however, they appear to be synonyms of *vaporariorum*. *Trialeurodes mossopi* was described from haricot beans in southern Rhodesia, *natalensis* from *Nicotiana tabacum* in Pretoria, South Africa, and *sesbaniae* from "*Sesbania tripelta*" (probably *S. tripetii* Hort.) in Canberra, Australia.

Trialeurodes desmodii Corbett (*3, pp. 243–245*) and *T. rara* Singh (*17, pp. 47–49*) may be synonyms of *vaporariorum* also, though this is uncertain from available information. *Trialeurodes tabaci* Bondar (*2, pp. 32–34*) is a valid species closely related to *vaporariorum*, in the opinion of the writer, who has studied type specimens of it.

Several authors have made conjectures concerning the origin of *vaporariorum*, some stating that it originated in Brazil and others expressing the opinion that Mexico was its native home. Little is known concerning the Neotropical species of *Trialeurodes* or the distribution of presumably Nearctic members of the group in the Neotropical Region. From the present study it is evident, however, that of the known representatives of the genus, *vaporariorum* is most closely related to the species occurring in the western and southwestern part of North America. On the basis of present information it appears likely that *vaporariorum*, as well as these other species, are indigenous to this general area. There apparently is little basis for the assumption that the species originated in Brazil.

Trialeurodes vaporariorum is doubtless the most economically important species of the genus. Being nearly world-wide in distribution and living on numerous plants, it is recognized as a pest both indoors and outside.

Particular interest also attaches to *vaporariorum* because of its unusual parthenogenetic behavior. An American race and an English race are said to exist, the difference between the two being that when they reproduce parthenogenetically, the American race gives rise to males and the English race to females. Morrill (*14*), Hargreaves (*6*), Williams (*23*), Stoll and Schull (*18*), Schrader (*15, 16*), and Thomsen (*20, 21*) have contributed to our knowledge of these races. Schrader's work and that of Thomsen deal partially with the cytology of the two forms and their studies appear to indicate that the two races belong to one species, though Thomsen remarks that (*20*), "So close a resemblance in the behaviour of the chromosomes within the same species between obligatorily parthenogenetic eggs and eggs that can be fertilised has been found in scarcely any other animal." Goldschmidt (*5, p. 128*) expressed his opinion concerning the significance of the parthenogenetic behavior of the races as follows: "* * * the rarity of such cases precludes any evolutionary significance, except for the presence of a more or less freakish type of microevolution of the nature of a blind alley within the confines of a species."

Despite the apparent belief that the two races belong to the same species, many workers doubtless have wondered whether they represented two morphologically distinct segregates. Such a question has been entertained by the present writer, and the matter has been given every possible attention in this study. Unfortunately, no pupae from which adults emerged which were used in experimental studies of the two races have been available to the writer, though some typifying both kinds of development certainly must have been present in the material studied by her. Specimens from two lots of material, presumably from Thomsen, labeled "English race" and "American race," respectively, are at hand. The insects from these lots are similar morphologically and agree with representatives present both in Europe and America. In fact, all morphological segregates of *vaporariorum* observed by the writer from England have also been observed from America. Thus, if the races are distinguishable morphologically, they may both be present in America although the available figures on the sex ratio in this country do not indicate this. Both races are said to be present in England and Denmark, however. Without pupae which are known positively to represent the two races, it is impossible to determine whether differences in parthenogenetic behavior can be correlated with conspicuous though apparently unimportant differences in structure.

Trialeurodes vaporariorum, as it is here defined, consists of an assemblage of specimens showing three main lines of divergence and several lesser ones, the latter rather unquestionably representing minor variation. The differences between the more distinct individuals are principally in the papillae, the length of the eighth abdominal setae, and in the size of the body. These differences, though sometimes very conspicuous, do not seem important, because they are not constant, because there is practically every degree of intergradation from one extreme to the other, because they seem to depend partially upon the type of leaf on which the insects develop, and because the same differences are found in several other species which are undoubtedly more restricted in their hosts and distribution.

It may be desirable to discuss briefly the trends in the development of this species. In general, individuals developing upon lightly or moderately pubescent leaves have four pairs of well developed dorsal papillae and several pairs of submarginal ones that are markedly larger than the majority; the submarginal ones are situated fairly near the body margin and the majority of them point diagonally or vertically. The eighth abdominal setae may be short or long, and the specimens are of moderate size. This segregate was encountered more often than any other by the writer, the specimens labeled "English race" and "American race" are representative of it, and it apparently is the one described by Westwood as *vaporariorum*. Also cotype specimens of *papillifer* and some of those of *nicotianae* and *sonchi* are like this. From their descriptions, *mossopi*, *natalensis*, and some specimens of *sesbaniae* appear to be typical of these insects.

In some insects developing on smooth leaves, the dorsal papillae are poorly developed or are not apparent, and usually the submarginal ones are less variable in size (some may be degenerate in specimens from very tough leaves), are closer to the body margin, and the majority of them point laterally or diagonally. The eighth abdominal setae are short and the caudal ones usually are long, but may be short in specimens from leaves whose epidermis is unusually tough. The specimens tend to be larger than those from pubescent leaves. Some cotype specimens of *nicotianae* are representative of this category, and from its description some of those of *sesbaniae* appear to be. The description of *sonchi* refers to this segregate and some of its cotype specimens belong here, as apparently do also the insects assigned to *sonchi*[9] by Laing.

Specimens living on densely pubescent leaves usually are smaller than those on other types of leaves, and they often have more than four pairs of dorsal papillae. The submarginal papillae tend to be rather far from the body margin, and considerably reduced in size, though the posterior and an anterior pair usually are fairly large. The eighth abdominal setae are nearly always long in this segregate.

Although these trends are apparent in a great number of specimens they are far from being relatively constant even on one type of host. The following example is illustrative of the available evidence concerning the probable effect of the type of host upon the development of the variable structures just discussed. Numerous insects were collected by the writer from the hairy leaves of a gourd vine trained diagonally from the ground to a porch about 10 feet high. Some specimens were also collected from the relatively smooth leaves of a sassafras tree about 4 feet tall which grew underneath the gourd vine. The sassafras doubtless became infested from the gourd, since it was almost contiguous to it, since adults were swarming on both plants, and since sassafras trees a few feet away were not infested. Although nearly all pupae from the gourd vine were typical of *vaporariorum* as it often appears on extremely pubescent leaves, all specimens from the sassafras tree were representative of the insects most common on slightly pubescent leaves.

Thus, on the basis of available evidence, it appears to be impossible to recognize these segregates as specific or subspecific entities. Breeding experiments should be conducted, however, to obtain biological evidence either for or against their recognition.

With the characteristics of the group. Mounted insects 0.75–1.10 mm. long and 0.50–0.75 wide. Rarely 9 (in very large specimens only), but usually 12 marginal crenulations in 100 μ; each tracheal pore area usually plainly marked by narrowness and depth of 3–10 crenulations and thoracic ones (and sometimes

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[9] Laing suggested that *sonchi* might be a synonym of *Lecanium complanatum* Baerensprung. This point cannot be ascertained now, however, because the description of *complanatum* is inadequate for the recognition of the species, and no specimens of it are available. It antedates *vaporariorum*, having been described in 1849 (*1, pp. 169–170*).

abdominal one) by a pore-shaped design on submarginal ridges. Submarginal papillae totaling 64–140 (usually 75–110), all or any number of them either well developed or degenerate, but the majority at least fairly well developed in most specimens; 1–9 pairs distinctly larger than others and nearly all papillae pointing somewhat diagonally or vertically, or all about same size and majority pointing laterally or diagonally; when 1 large pair is present it is the posterior pair and is situated distinctly anterior to caudal setae, and the others usually are at least the width of a papilla from body margin; if 6 large pairs are present, usually 2 are on cephalic segment, 1 on prothoracic segment, 1 just posterior to transverse molting suture, and 1 each on sixth and eighth abdominal segments, all papillae in this case about the width of a papilla from body margin; if all are nearly uniform in size they tend to be about half the width of a papilla from body margin and around 12 μ long and 16 wide; in other cases the smaller papillae are 8–16 μ long and 12–20 wide and the larger ones 20–28 μ long and wide; broadly conical if well developed, and their apices fairly acute. Submarginal disk pores on inner part of circumference of larger papillae, usually distad of others and closer to them than to body margin. Posterior pair of setal bases distad of papillae and usually bearing setae about 4 μ long, other setal bases usually mesad of submarginal papillae and without distinguishable setae.

Dorsal disk pores arranged as for the group. Usually 4 pairs of subdorsal papillae well or poorly developed, 1 pair being on each of cephalic, mesothoracic, and third and fourth abdominal segments, directed vertically, nearly uniform in size, 20–32 μ long and wide, also a pair sometimes on other thoracic segments and on each of abdominal segments 5–7. Length of setae about as follows: Anterior marginal, 6–10 μ; cephalic, 10–14 μ; first abdominal, 8–12 μ; eighth abdominal, 10–100 μ (usually either 10–20 or 70–100); caudal, 36–84 μ (usually 60–76); posterior marginal, 24 μ. Vasiform orifice 56–76 μ long and 56–70 wide. Operculum 36–48 μ long and 44–60 wide. Lingula 40–60 μ long and 24–32 wide.

Ventral abdominal setae 28 μ long.

HOSTS.—*Abutilon* sp., *Achimenes* sp., *Ageratum* spp., *Althaea* spp., *Aquilegia* sp., *Aralia cordata* Thunb., *Arbutus menziesii* Pursh and *A. unedo* L., *Arctostaphylos media* Greene, *Argania sideroxylon* Roem. and Schult., *Assonia wallichii* (Lindl.) Benth. and Hook. f., *Aster* sp., *Avicennia nitida* Jacq., *Azalea schlippenbachi* (Maxim.) Ktze., *Azalea* sp., *Berberidopsis* sp., *Bidens pilosa* L., *Bouvardia* sp., *Brassica* sp., *Brunfelsia hopeana* Benth., *B. mutabilis* Poit., *Caladium* sp., *Carya pecan* (Marsh.) Engler and Graebn., *Catalpa* sp., *Ceanothus thyrsiflorus* Esch., *C. veitchianus* Hook., *Ceanothus* sp., *Ceratostigma willmottianum* Stapf, *Cestrum parqui* L'Her., *Chrysanthemum* sp., *Citrus* spp., *Clematis ligusticifolia* Nutt. (cotypes of *glacialis*), *Coleus* sp., *Colocasia esculenta* (L.) Schott, *Cotoneaster frigida* Lindl., *Cucurbita pepo* var. *ovifera* (L.) Bailey, *Cucurbita* sp., *Daphne cneorum* L., *Digitalis* sp., *Dioon spinulosum* Dyer, *Dodonaea viscosa* L., *Erigeron neomexicanus* Gray, *E. scaposus* DC., *E. scaposus* var. *latifolius* DC., *Eucalyptus algeriensis* Trabut, *E. trabuti* Vilm., *Eucryphia cordifolia* Cav., *Eugenia aquea* Burm. f., *Eupatorium glandulosum* HBK., *Euphorbia dictyosperma* Fisch. and Mey., *Euphorbia* (*Poinsettia*) sp., *Fragaria nilgerrensis* Schlecht., *Fragaria* sp., *Fraxinus* sp., *Fuchsia* spp., *Gardenia* sp., *Gaultheria shallon* Pursh, *Geranium* spp., *Gladiolus* sp., *Gossypium* sp., *Helianthus* sp., *Hibiscus mutabilis* L., *Hypericum* sp., *Ilex intricata Hook. f.*, *Ipomoea batatas* (L.) Lam., *Jasminum stephanense* Javit, *Lactuca serriola* L., *Lantana* spp., *Lobelia* sp., *Lonicera interrupta* Benth., *L. ruprechtiana* Regel, *Loropetalum chinense* Oliv., *Lycopersicon* sp., *Magnolia* sp., *Malvastrum coromandelianum* (L.) Garcke, *Medicago* sp., *Mentha citrata* Ehrh., *M. piperita* L., *Mutisia decurrens* Cav., *Mutisia* sp., *Myrtus communis* L., *Nerium* sp., *Nicotiana glauca* Graham, *Nicotiana* sp. (cotypes of *nicotianae* and other specimens), *Nothofagus* sp., *Olea europaea* L., *Oplopanax elatus* Nakai, *Oxalis* sp., *Parthenium* sp., *Paulownia tomentosa* (Thunb.) Steud., *Pelargonium* sp., *Persea* sp., *Phaseolus* spp., *Philadelphus* sp., *Photinia arbutifolia* (Ait.) Lindl., *Physocarpus capitatus* (Pursh) Ktze. (cotypes of *glacialis* and other specimens), probably *Pittosporum eugenioides* A. Cunn. (cotype of *papillifer*), *Polygala* sp., *Primula obconica* Hance, *Primula* sp., *Prostanthera rotundifolia* R. Br., *Prunus persica* (L.) Batsch, *Prunus* (*Prunophora*) sp., *Psidium guajava* L., *Quercus* sp., *Rhamnus californica* Esch., R. *crocea* Nutt., *R. purshiana* DC., *Rhododendron arboreum* Smith, *R. macrophyllum* G. Don, *Rhododendron* sp., *Ribes sanguineum* Pursh, *Ribes* sp., *Ricinus communis* L., *Rosa banksiae* Ait., *Rosa* sp., *Rubus vitifolius* Cham. and Schlecht. (cotypes of *glacialis* and other specimens), *Rubus* sp., *Salix* sp., *Salvia* sp., *Sanchezia* sp., *Sapium sebiferum* L., *Sassafras albidum* (Nutt.) Nées, *Solanum carolinense* L., *S. pseudocapsicum* L., *Solanum* sp., *Sonchus oleraceus* L. (cotypes of *sonchi* and other specimens), *Sphaeralcea* sp., *Spiraea vanhouttei* (Briot) Zabel, *Symphoricarpos racemosus* Michx. (cotypes of *glacialis*), *Taraxacum* sp., *Trifolium pratense* L., *Trifolium* sp., *Vaccinium* sp., *Verbena* sp., *Verbesina virginica* L., *Viola* sp., *Xanthium* sp., *Zinnia* sp.

Distribution.—Alaska: Anchorage. Canada: British Columbia, Ontario.

United States: Alabama, California (Stevens Creek, cotype of *glacialis*), Colorado, Connecticut, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Nebraska, New Jersey, New Mexico, New York, Ohio, Oregon, Pennsylvania, Rhode Island, Utah, Virginia, Washington, West Virginia, Wisconsin.

Mexico: Durango, Guanajuato (Guanajuato, cotypes of *nicotianae*), Jalisco, Morelos, Nuevo Leon, Sonora.

Guatemala, British Guiana, Colombia, Chile, Hawaii (Honolulu, cotypes of *sonchi*), Australia, New Zealand (probably Christchurch, cotype of *papillifer*), South Africa (Pretoria), Germany, Denmark, Norway, England.

Redescribed from a mass of unmounted material and around 1,500 mounted specimens.

TRIALEURODES VARIA Quaintance and Baker

Trialeurodes varia Quaintance and Baker, *in* J. Baker, 1937 [Mex.] Inst. de Biol. An. 8: 620–621, illus.

In *varia*, as in *vaporariorum*, the number of dorsal papillae and the length of the eighth abdominal setae varies conspicuously. In this case, however, there appears to be no correlation between the variation and the physical character of the leaves on which the insects live, the same differences being present in specimens from one leaf. All leaves harboring *varia*, seen by the writer, were smooth or sparsely pubescent, and were rather heavily infested.

With the characteristics of the group. White powdery wax sometimes present in median area. Colorless, yellowish, or subdorsal ridge and sometimes rest of derm light brownish. Mounted insects 0.75–0.90 mm. long and 0.50–0.60 wide. Each tracheal pore area unusually well marked by the narrowness of 3 or 4 crenulations and the presence of a pore-shaped design on submarginal ridges. Submarginal papillae in a single irregular row of 58–78, situated unusually distant from body margin, majority about three times the width of a papilla from body margin

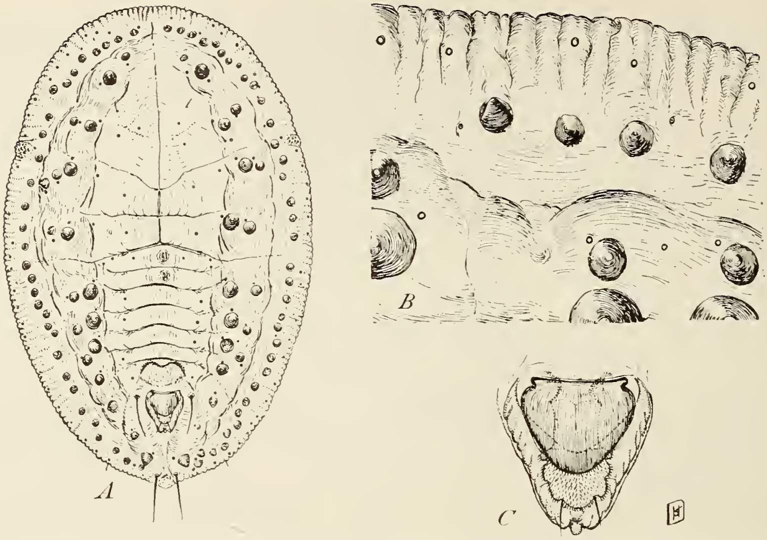

Figure 19.—*Trialeurodes varia: A*, Outline, shaded to show subdorsal ridge; *B*, section of margin, submargin, and subdorsum; *C*, vasiform orifice.

and around the width of a papilla apart, the majority directed upward, broadly conical, tips blunt, 8–12 μ long and wide, but a posterior pair 20–24 μ long and 16–20 wide and situated cephalad or mesad of penultimate pair, rarely a cephalic one distinctly larger than the average. Majority of submarginal disk pores one-third nearer body margin than papillae but mesad of posterior papillae. Posterior pair of submarginal setal bases distad of, most of others in line with, submarginal papillae; no setae distinguishable.

Dorsal disk pores as stated for the group. A conspicuous, subdorsal ridge (not separating submargin from dorsal disk) present. Dorsal papillae located on ridge, 13–36 (usually at least 26) present, usually 1 pair on each body segment except anterior 2 abdominal, and 2 pairs on each thoracic and on abdominal segments 3 and 4, one on most segments as large as, or larger than, posterior submarginal one, and others about size of smaller submarginal ones. A median tuberculate area on each of first and second abdominal segments and a swollen area just posterior to pockets. Length of setae approximately as follows: Anterior marginal, 5 μ; cephalic, 12–16 μ; first abdominal, 12–16 μ; eighth abdominal, 16–72 μ (usually 16–30 or 60–72); caudal, 50–60 μ; posterior marginal, 24 μ. Anterior margin of vasiform orifice located about two-thirds width of orifice from posterior suture, orifice 52–64 μ long and 48–56 wide. Operculum 32–40 μ long and 44–52 wide. Lingula 40–44 μ long and 30 wide. Grooves beside orifice and caudal furrow particularly well defined.

Ventral abdominal setae 28 μ long.

Hosts.—*Datura* sp., Rosaceae (probably *Rosa* sp.) (cotypes), unidentified hosts.

Distribution.—Mexico: Puebla, State of Puebla (cotypes and other specimens); unstated locations.

Redescribed from numerous unmounted and 28 mounted specimens. Although the species was originally described from 2 specimens from an unnamed plant, several additional insects from the same lot have now been examined. The host has also been identified as belonging to the Rosaceae, probably being a species of *Rosa*.

TRIALEURODES GLACIALIS (Bemis)

Aleyrodes glacialis Bemis, 1904, U. S. Natl. Mus. Proc. 27: 518–519, illus., in part.

Asterochiton glacialis (Bemis), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105, in part.

Trialeurodes glacialis (Bemis), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi, in part.

Bemis' description and illustrations of *glacialis* refer largely to the insects here redescribed. Parts of her description, however, treat of the species *drewsi*, *vaporariorum*, and *vittata*, and most specimens designated by Bemis as cotypes of *glacialis* actually belong to these other segregates.

In the few specimens available for study the number of submarginal and dorsal papillae varies considerably and the length of the eighth abdominal setae varies slightly. This species is known only from hairy leaves and occurs sparingly.

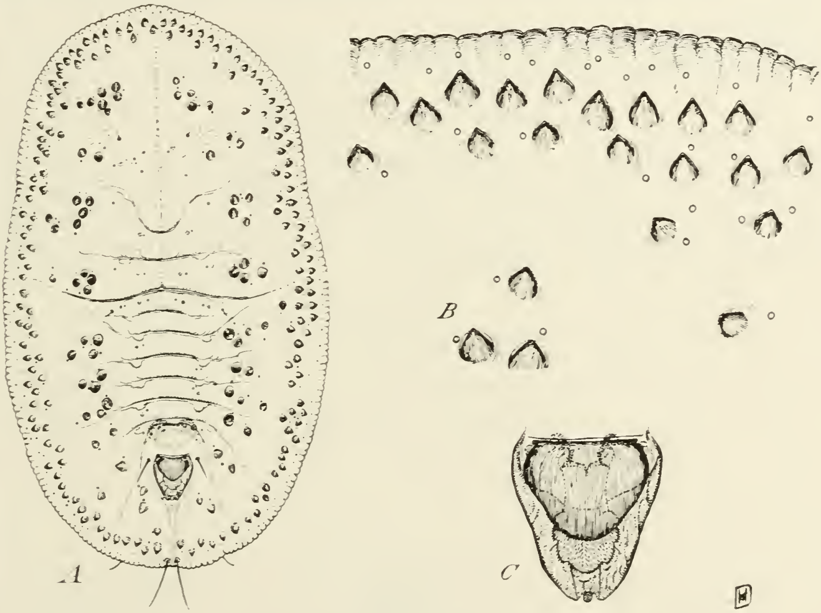

FIGURE 20.—*Trialeurodes glacialis:* *A*, Outline; *B*, section of margin, submargin, and subdorsum; *C*, vasiform orifice.

Typical of the Vaporariorum Group in most respects. Mounted insects 0.80–0.85 mm. long and 0.50–0.55 wide. Thoracic tracheal pore areas usually inevident though sometimes marked by a slight indentation in 2 or 3 crenulations, abdominal one marked by narrowness of 3 or 4 crenulations. Submarginal papillae in an irregularly single, crowded row to an irregularly triple one, 115–175 present, 10–20 μ long and 8–16 wide but the majority 14 μ long and 12 wide, rather narrowly conical, tips acute and majority directed strongly diagonally to vertically but a few pointing laterally; outer ones around twice the width of an average papilla from body margin, usually less than the width of a papilla apart. Submarginal disk pores of outer papillae mostly in line with latter's apices, those of inner papillae mostly laterad of them. Posterior pair of submarginal setal bases bearing setae as much as 5–8 μ long, other bases in line with or mesad of papillae, penultimate pair sometimes with distinguishable setae.

Dorsal disk pores more numerous than stated for Vaporariorum Group, usually 2–4 additional subdorsal pairs on all cephalothoracic segments except prothoracic, and on abdominal segments 3 and 4, and 1 additional pair on each of posterior 4 segments. Dorsal papillae directed vertically, usually numerous, often present near subdorsal disk pores, or if not well developed, indicated by very membranous areas, and similar areas often near submedian pores; when well developed usually 1 on each segment larger than majority of submarginal ones, but showing same range in size and nearly same shape as the latter though usually more blunt at tip. A swollen area just posterior to pockets. Length of setae about as follows: Anterior marginal, 4–6 μ; cephalic, 8 μ; first abdominal, 8 μ; eighth abdominal, 40–105 (usually 40 or 85–105); caudal, 52–100 μ; posterior marginal, 24 μ. Vasiform orifice 56–64 μ long and 52–60 wide, its anterior margin about five-sixths the width of the orifice from seventh abdominal suture. Operculum 36–40 μ long and 48–52 wide. Lingula 44 μ long and 28 wide.

Ventral abdominal setae 28 μ long.

Hosts.—*Ceanothus cyaneus* Eastw., *C. veitchianus* Hook., *Ceanothus* sp. (cotypes).

Distribution.—California: Los Angeles, Niles, Pacific Congress Springs (cotypes), Santa Barbara, Stanford University Campus (cotypes).

Redescribed from meager unmounted material and 33 mounted specimens, some of which were loaned by G. F. Ferris.

TRIALEURODES DREWSI Sampson

Trialeurodes drewsi Sampson, 1945, Pan-Pacific Ent. 21: 62, illus.
Aleyrodes glacialis Bemis, 1904, U. S. Natl. Mus. Proc. 27: 518–519, in part.
Asterochiton glacialis (Bemis), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105, in part.
Trialeurodes glacialis (Bemis), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi, in part.

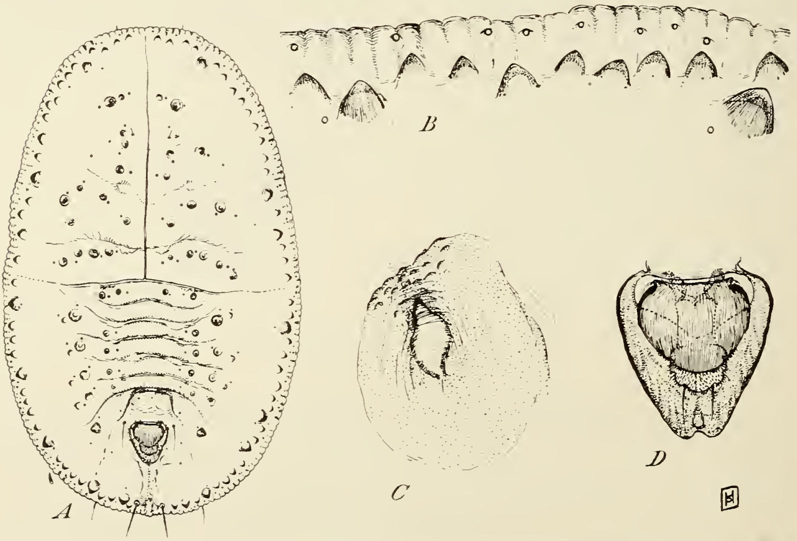

Figure 21.—*Trialeurodes drewsi:* *A*, Outline; *B*, section of margin and submargin; *C*, thoracic spiracle; *D*, vasiform orifice.

In the description of *drewsi* Sampson states "* * * stomata-like pores * * * lingula * * * without setae * * * case black * * *." The "stomata-like pores" are not actually pores; they are the submedian depressions of the present paper. The lingula bears the setae typical of the genus *Trialeurodes*. The holotype is dark owing to parasitization; unparasitized representatives of the species are light in color.

Several insects originally described and listed as cotype specimens of *glacialis* are distinct from that species, and are here assigned to *drewsi*.

Like most of the other species of the Vaporariorum Group, *drewsi* exhibits conspicuous variation in the number of well developed dorsal papillae and in the length of the eighth abdominal setae. Variation in the papillae apparently can be correlated with pubescence of the leaves, the insects from tomentose leaves having the greatest number of papillae. On the contrary, specimens from glabrous leaves have the longest setae. Some of the leaves at hand were nearly covered by insects.

Characteristic of group. Mounted specimens 0.75–0.85 mm. long and 0.50–0.60 wide. Each thoracic tracheal pore area inevident or weakly marked by a few striations on 2 submarginal ridges, abdominal one marked by narrowness of 3–5 crenulations. Submarginal papillae broadly conical with apices rather blunt, arranged in an irregularly single and double row of 68–136, majority directed diagonally but usually some pointing laterally and some vertically, measuring 10–16 μ long and 12–20 wide, about the width of a papilla from body margin, and usually about half that distance apart but sometimes contiguous; 12–20 (usually 18) slightly mesad of smaller ones, which are 16–20 μ long and 20–24 wide, usually 6 of these on cephalothorax and 12 on abdomen, posterior pair in line with penultimate pair. Majority of submarginal disk pores about halfway between papillae and body margin, but those of largest papillae often some distance mesad of them. Submarginal setal bases in line with or slightly mesad of papillae, without distinguishable setae except for posterior pair where they are sometimes apparent.

Dorsal disk pores about as stated for Vaporariorum Group, but sometimes an additional subdorsal pair on any one of the posterior 3 or 4 segments. Papillae well developed near few or many disk pores, or indicated by a more membranous area, but none on second or eighth abdominal segment; when well developed similar in shape and size to submarginal ones, but the majority tending to be rather blunt and the submedian ones as well as at least 1 pair of subdorsal ones usually small, and 1 subdorsal pair large. Length of setae approximately as follows: Anterior marginal, 2–4 μ; cephalic, 6–8 μ; first abdominal, absent; eighth abdominal, 40–100 μ (usually 40 or 80–100); caudal, 56–100 μ (bases in line with or anterior to inner submarginal papillae); posterior marginal, 24 μ. Vasiform orifice 52–64 μ long and 44–52 wide, usually without a tooth in notch of rim though with the usual one in orifice. Operculum 32–44 μ long and 36–48 wide. Lingula 32–48 μ long and 20–28 wide, its long setae not reaching edge of orifice.

Ventral abdominal setae 36–44 μ long.

HOSTS.—*Lithocarpus densiflorus* (Hook. & Arn.) Rehder (cotypes of *glacialis* and other specimens), *Quercus agrifolia* Nées, *Q. dumosa* Nutt., *Q. tomentella* Engelm., *Quercus* sp. (holotype).

DISTRIBUTION.—California: "Big River Canon, Mendocino County," Kings Mountain (cotypes of *glacialis*), Los Angeles, Mount Tamalpais (holotype), Muir Woods (Marin County), "Palmers Canyon," Willits, Santa Catalina Island.

Redescribed from a number of unmounted and 52 mounted specimens.

The holotype was loaned by G. F. Ferris.

TRIALEURODES DIMINUTIS (Penny), new combination

Asterochiton diminutis Penny, 1922, Jour. Ent. and Zool. 14: 28–30, illus.

Trialeurodes diminutis departs from the other members of this group in that the operculum occupies the greater part of the vasiform orifice and covers the entire lingula. It is also unique among the species studied by the writer in having its vertical palisade of wax conspicuously higher at the anterior end of the body than at the posterior end. The insect is known from a glandular, pubescent host, and the few specimens examined show considerable variation in number of papillae though not in length of setae. This is possibly the most distinctive species of the Vaporariorum Group known at the present time.

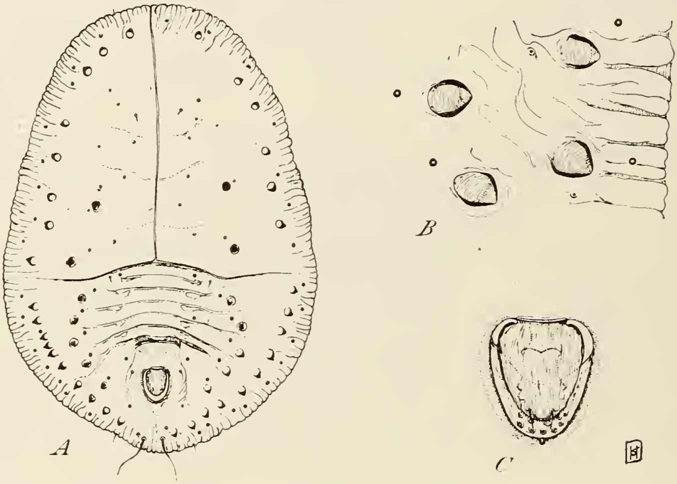

FIGURE 22.—*Trialeurodes diminutis: A,* Outline; *B,* section of margin, submargin, and subdorsum; *C,* vasiform orifice.

Living on both surfaces of leaves, cephalic end of insect toward attached end of leaf. Vertical palisade of wax unusually high at anterior end of body, its height at this point equal to width of body, sloping gradually to posterior end where it is about half its height at anterior end.

Typical of Vaporariorum Group in most respects. As mounted, 0.50–0.70 mm. long and 0.35–0.50 wide. Each thoracic tracheal pore area faintly marked by a slight attenuation of 1 or 2 marginal crenulations, abdominal one indicated by narrowness of 4 or 5 crenulations. Submarginal papillae usually in a single row but often irregularly double in spots if more than 50 are present, 30–67 observed, the width of a papilla to four times that distance apart and two to three times the width of a papilla from body margin, directed diagonally or laterally, broadly conical, 10–16 μ long and wide. Practically all submarginal disk pores slightly nearer to body margin than to papillae, but posterior ones usually laterad of posterior papillae. Submarginal setal bases in line with or slightly mesad of papillae, without readily distinguishable setae.

Dorsal disk pores less numerous than stated for Vaporariorum Group, usually only 1 subdorsal pair on any segment, only 1 submedian pair on any segment, and usually without a submedian pair on one or another of abdominal segments 3–6. A pair of subdorsal papillae usually present laterad of pores on mesothoracic and metathoracic segments, on each of abdominal segments 3–5, and sometimes on 6 and 7; of same size and shape as larger submarginal ones, posterior pairs usually smallest, all directed vertically. Length of setae as follows: Anterior marginal, 2 μ; cephalic, 2–4 μ; first abdominal, 4 μ; eighth abdominal, 8 μ (located closer to seventh abdominal suture than to orifice); caudal, 75 μ; posterior marginal, 8 μ. Rim of vasiform orifice poorly differentiated from adjacent body derm, top of orifice smaller than cavity itself, notch in rim small and with a small tooth but without the usual one in orifice, orifice 48–56 μ long and 40–48 wide. Operculum 36–48 μ long and 36–40 wide, covering entire lingula. Lingula 30–40 μ long and 24 wide, its long setae apparently not reaching end of orifice. Grooves beside orifice and caudal furrow very small, barely distinguishable.

Ventral abdominal setae apparently 32 μ long.

Host.—*Chamaebatia foliolosa* Benth. (cotypes).

Distribution.—California: Placerville (cotypes).

Redescribed from a few unmounted and 21 mounted specimens loaned by D. D. Penny and E. S. Ross.

TRIALEURODES NOTATA, new species

In contrast to its closest relatives, *notata* is known exclusively from the midwestern and eastern parts of the United States, where it has been collected principally from plants growing wild. Although the species is known from the lower surface of only moderately pubescent leaves, it displays striking variation in its papillae and in the length and position of the eighth abdominal setae. *T. notata* is closely related to *vaporariorum*, but it possesses certain characteristics that are found rather commonly in species of the Pergandei Group, the majority of which are believed to be indigenous to eastern North America. The position of the eighth abdominal setae, when small, is slightly farther caudad than in western species of the Vapariorum Group; in insects from the upper surface of leaves the vasiform orifice, operculum, and lingula are conspicuously larger than in specimens from the lower surface of the same leaves; also, the female pupae are rather larger, as compared with the males, than are most species of the Vaporariorum Group. In other respects, however, it resembles the species of the Vaporariorum series.

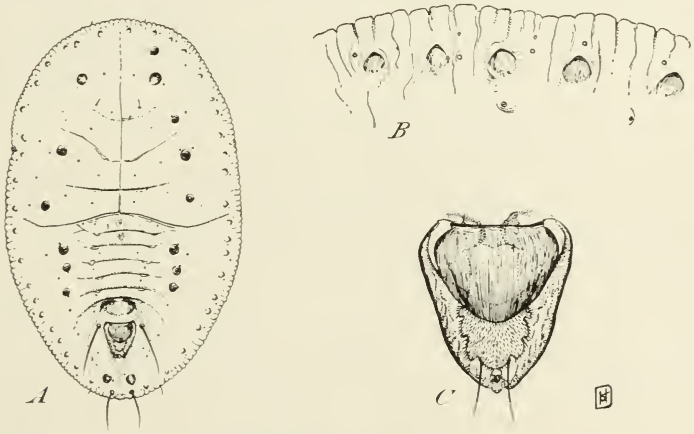

Figure 23.—*Trialeurodes notata*, male pupa: *A*, Outline; *B*, section of margin and submargin; *C*, vasiform orifice.

Occasionally found on the upper surface of leaves, but more abundant on the lower surface. Characteristic of Vaporariorum Group in most respects. Mounted insects 0.65–0.95 mm. long and 0.40–0.60 wide (males 0.65–0.75 mm. long and 0.40–0.50 wide, females 0.75–0.95 mm. long and 0.50–0.60 wide). Each tracheal pore area plainly marked by narrowness of 3–6 marginal crenulations and a pore-shaped area of varying prominence (usually very conspicuous) on submarginal ridges. Submarginal papillae in a single row of 42–72, majority pointing diagonally or vertically when well developed, rather roundly conical, nearly uniform in size except for posterior pair and occasionally a cephalic pair; when well developed around 12 μ long and wide but all or any number reduced in size or completely degenerate; posterior pair most persistent, 16–20 μ long and wide, located anterior to penultimate pair; when well developed usually at least the width of a papilla apart and from body margin; papillae often dropping out where body margin has grown against hairs of leaf. Submarginal disk pores halfway between papillae and body margin usually, but mesad of large anterior and posterior pairs.

Dorsal disk pores as stated for group. A pair of subdorsal papillae usually well developed on each of cephalic, mesothoracic, and third and fourth abdominal segments, but sometimes only anterior 3 of these pairs present or 1 or 2 additional pairs on thorax and 1 on abdominal segment 5; the 3 or 4 typical pairs 20–28 μ long and wide or reduced in size, any others present smaller than typical ones. A median tuberculate area on each of abdominal segments 1 and 2, area posterior to pockets swollen. Length of setae as follows: Anterior marginal, 6 μ; cephalic, 12 μ; first abdominal, absent; eighth abdominal, 12–24 μ and located rather close to orifice opposite its widest part, or 72–100 μ and situated as for this group (holotype and majority of specimens with long setae); caudal, 64–80 μ; posterior marginal, 20 μ. Anterior margin of vasiform orifice around two-thirds width of orifice from posterior suture, orifice 52–84 μ long and 48–64 wide (up to 72 μ long and 58 wide on lower surface of leaves). Operculum 32–44 μ long and 44–56 wide (up to 40 μ long and 48 wide on lower surface of leaves). Lingula 40–64 μ long and 24–30 wide (up to 52 μ long and 28 wide on lower surface of leaves). (Males from lower surface of leaves in lowest brackets of figures.)

Ventral abdominal setae 20 μ long.

HOSTS.—*Ambrosia trifida* L., *Eupatorium purpureum* L., *Helianthus tuberosus* L., *Helianthus* sp., *Lactuca* sp., *Mentha canadensis* L., *Physalis heterophylla* Nées, *Rudbeckia hirta* L., *Solanum carolinense* L., and an unknown host.

DISTRIBUTION.—District of Columbia: Takoma Park. Kansas: Lawrence. Maryland: Silver Spring, Takoma Park. Missouri: Cross Keys, and an unstated locality. New York: Crown Point. Pennsylvania: North East. Virginia: Falls Church.

Described from a number of unmounted specimens and 44 mounted ones collected as follows: *Ambrosia trifida*, Lawrence, R. H. Beamer, October 6, 1943; *H. tuberosus*, Cross Keys, R. B. Swain, October 18, 1932; Missouri, October 24, 1897, no other data; *E. purpureum*, North East, R. A. Cushman, July 31, 1916; *Lactuca* sp., Falls Church, Floyd Andre, August 13, 1942. Remaining material collected by the writer as follows: *A. trifida*, Washington, August 27, 1941, and Silver Spring, October 22, 1941; *E. purpureum*, Silver Spring and Takoma Park, Md., October 22, 1941; *Helianthus* sp. (holotype and paratypes), Takoma Park, D. C., September 10, 1941; *M. canadensis*, Silver Spring, October 5, 1941; *P. heterophylla*, Crown Point, July 13, 1942; *R. hirta*, Crown Point, July 8, 1941; *S. carolinense*, Crown Point, July 13, 1942.

PERGANDEI GROUP

There are seven species which can properly be assigned to the Pergandei Group—*pergandei*, *packardi*, *fernaldi*, *ruborum*, *vittata*, *heucherae*, and *magnoliae*. This group is quite distinct from the preceding four and also from the Abutilonea Group. All these species appear to be indigenous to eastern North America except *vittata* which is known only in the western part of this country. Only *packardi* is known to be widespread and only that species has been reported as being particularly injurious. There is a probability that *vittata* may be destructive, however, because it is sometimes abundant.

Different types of leaves are attacked by some of these species, and the appearance of such insects often differs conspicuously. The type of the genus is a distinctive member of the group.

The following diagnosis characterizes this group:

Massive white, waxy, fibrous secretions absent except in *pergandei*. Dorsal and ventral layer of wax brittle and easily removed from body. Other waxy secretions typical of the genus.

Marginal crenulations fairly uniform in width, relatively narrow, at least 20 in 100 μ; submarginal ridges small, usually apparent to papillae; thoracic tracheal pore areas usually inevident, but if apparent neither conspicuous nor characteristic; abdominal tracheal pore area usually indicated by the wideness of 3–8 crenulations. Submarginal papillae in a single or double row. Submarginal disk pores mesad of papillae. Submarginal porettes often unusually large and conspicuous, situated at bases of papillae. Submarginal setal bases apparently in 7 pairs on cephalothorax and in 6 on abdomen, setae usually indistinguishable.

Pairs of dorsal disk pores usually arranged approximately as follows (except in *pergandei*): Two subdorsal on each cephalothoracic segment and 1 subdorsal on each of abdominal segments 3–8, 1–3 submedian on each thoracic segment, 2 submedian on first abdominal segment, and 1 submedian on each of abdominal segments 3–7 (somewhat more numerous in *vittata*). Dorsal porettes distinct, often membranous areas adjacent to them or around them. Dorsal papillae somewhat conical when present. Transverse molting suture curved slightly posteriorly, but recurved and reaching submarginal papillae opposite a point about midway between center of mesometathoracic suture and its own center (slightly posterior to this in *magnoliae*). Eight segments apparent in median area of abdomen. Pockets large, the interval between them usually no more than half the width of a pocket. Anterior marginal, cephalic, and first abdominal setae present as well as those typical of genus, all slender and tapering; eighth abdominal pair situated just posterior to widest part of orifice and usually close to it. Vasiform orifice cordate to elongate cordate, its anterior margin located slightly less than width of orifice from seventh abdominal suture, its posterior end usually one to one and one-fourth times length of orifice from body margin; rim absent from anterior end but pronounced elsewhere, turned cephalad at posterior tip and joining a large sharp tooth arising in orifice; bottom of orifice strongly rugose and moderately concave. Operculum cordate or elongate cordate, usually reaching to third pair of lobes of lingula (longer in *heucherae* and *magnoliae*). Lingula with 3 pairs of well-defined lateral lobes and a terminal one; long setae of lingula usually reaching to or just beyond edge of orifice. Grooves beside orifice and caudal furrow well defined.

Inner basal area of each leg at least slightly sclerotized and this area of middle legs sculptured; at least 1 stout spine in this area of each leg and a relatively elongate slender seta (usually about 8 μ long) mesad of each middle and posterior leg. Anterior abdominal spiracles usually indiscernable, appearing as slightly differentiated spots in derm if visible.

TRIALEURODES PERGANDEI (Quaintance)

Aleurodes pergandei Quaintance, 1900, U. S. Dept. Agr., Div. Ent., Tech. Ser. 8: 31–32, illus.; Quaintance, 1908, Homoptera, Fam. Aleyrodidae, *in* Wytsman, Genera Insectorum, fasc. 87, pp. 7, 11, illus.

Aleyrodes subgenus *Trialeurodes pergandei* (Quaintance), Cockerell, 1902, Acad. Nat. Sci. Phila. Proc. 54: 283; Kirkaldy, 1907, Hawaii Bd. Commrs. Agr. and Forestry, Div. Ent. Bul. 2: 44, 64; Quaintance, 1908, Homoptera, Fam. Aleyrodidae, *in* Wytsman, Genera Insectorum, fasc. 87, p. 4.

Asterochiton pergandei (Quaintance), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.

Trialeurodes pergandei (Quaintance), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi.

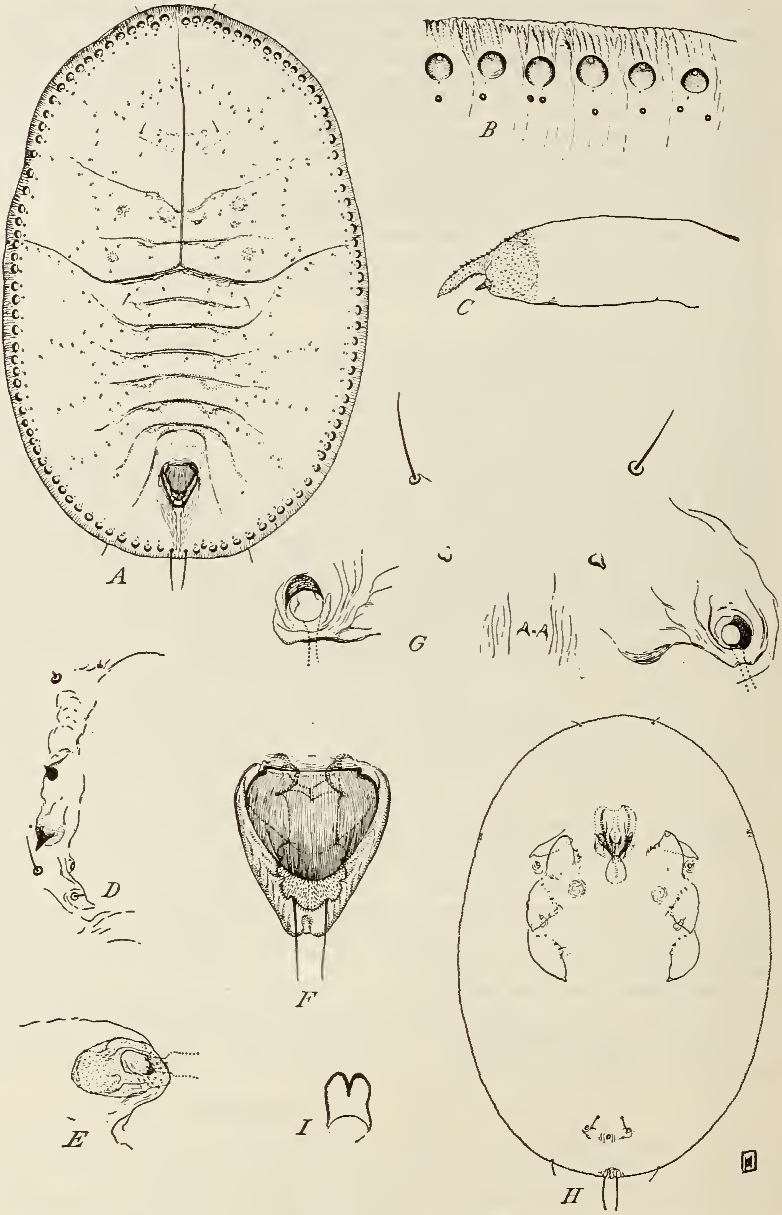

Figure 24.—*Trialeurodes pergandei: A*, Outline; *B*, section of margin and submargin; *C*, antenna; *D*, part of inner basal area of middle leg; *E*, thoracic spiracle; *F*, vasiform orifice; *G*, part of ventral surface showing posterior abdominal spiracles, arrangement of markings in derm sometimes present in mature female pupae, and ventral abdominal setae; *H*, male pupa, outline, showing ventral surface; *I*, same, bifid sac.

Trialeurodes pergandei, the type of the genus, is a distinctive species, exhibiting a pore arrangement unparalleled elsewhere in the genus, and being unusually stable in development. It occurs on smooth and slightly pubescent leaves but apparently does not contain such divergent specimens as are found in some species of this group.

Characteristic of group in most respects. Mature pupa with a conspicuous copious secretion of white, fibrous, waxy rods or columns arranged somewhat in the shape of a rosette, 1 column arising from central section of body and the others from the subdorsum, the columns curving outward and covering a space as much as five times the width of the insect. Other waxy secretions typical of genus. Nearly colorless or pale yellowish. Mounted insects 0.75–0.90 mm. long and 0.50–0.60 wide. Dorsal derm slightly sclerotized and fairly thick, ventral derm membranous.

Approximately 30 marginal crenulations in 100 μ. Submarginal papillae in a single regular row of 80–105, broad, 8–10 μ long and 12–16 wide, usually rounded at apex but sometimes bluntly pointed, directed laterally or diagonally, the majority slightly more than the width of a papilla apart and from body margin. Submarginal disk pores usually slightly more than the width of a papilla mesad of papillae. Submarginal setal bases about in line with disk pores.

Dorsal disk pores arranged somewhat differently than stated for this group, 3 broad shallow scallops on each half of cephalothorax and 3 half ovals on each half of abdomen, starting in outer subdorsum and extending to inner subdorsum; in addition 2 or 3 pairs of submedian pores on each thoracic segment, 2 on anterior abdominal segment, and 1 on each of abdominal segments 2–4, no submedian ones on abdominal segments 5–7, and no subdorsal ones on segment 8. Sometimes a very membranous area present near one of the submedian pores. Length of setae approximately as follows: Anterior marginal, 8–10 μ; cephalic, 16 μ; first abdominal, 16 μ; eighth abdominal, 16–20 μ; caudal, 48–64 μ (their bases in line with, or barely mesad of, submarginal papillae); posterior marginal, 20 μ. Vasiform orifice cordate, 52–68 μ long and 52–60 wide. Operculum cordate, 30–40 μ long and 40–52 wide. Lingula 32–44 μ long and 28–32 wide, its long setae extending beyond edge of orifice.

A very small spine and a poorly defined minute one on anterior leg, 1 spine about 5 μ long and another very small one on each middle and posterior leg. Ventral abdominal setae 24 μ long.

HOSTS.—*Bignonia radicans* L. (cotypes and other specimens), *Chionanthus virginica* L., *Crataegus stipulosa* (HBK.) Steud., *Crataegus* sp., *Fraxinus* sp., *Hydrangea* sp., *Prunus persica* (L.) Batsch, *Prunus* (*Cerasus*) sp., *Prunus* (*Prunophora*) sp., *Pyracantha angustifolia* (Franch.) Schneid., *Rosa wichuraiana* Crépin, *Rubus* sp., *Smilax* sp., *Viburnum dentatum* L.

DISTRIBUTION.—District of Columbia: Takoma Park, Washington (cotypes). Florida: Brooksville, Gainesville. Georgia: Atlanta, Pomona. Illinois: Urbana. Maryland: Glendale, Hyattsville, Silver Spring. South Carolina: Saluda County. Tennessee: Marion County, Roane County. Virginia: Wedderburn, and an unstated locality.

Redescribed from a small number of unmounted insects and 89 mounted ones.

TRIALEURODES PACKARDI (Morrill)

Aleyrodes packardi Morrill, 1903, Canad. Ent. 35: 25–35, illus.; Morrill, 1903, Mass. Agr. Expt. Sta. Tech. Bul. 1: 53–66, illus.

Asterochiton packardi (Morrill), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.

Trialeurodes packardi (Morrill), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi.

Aleyrodes coryli Britton, 1907, Ent. News 18: 337–339, illus. (New synonymy.)

Asterochiton coryli (Britton), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.
Trialeurodes coryli (Britton), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi.
Aleyrodes waldeni Britton, 1907, Ent. News 18: 339–340, illus. (New synonymy.)
Asterochiton waldeni (Britton), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.
Trialeurodes waldeni (Britton), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi.
Aleyrodes morrilli Britton, 1907, Ent. News 18: 340–342, illus. (New synonymy.)
Asterochiton morrilli (Britton), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.
Trialeurodes morrilli (Britton), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi.
Trialeurodes vaporariorum (Westwood), Baker and Moles, 1921, Rev. Chilena de Hist. Nat. 25: 645, in part.
Trialeurodes n. sp., Kansas Agricultural Experiment Station, 1940, Kans. Agr. Expt. Sta. Bien. Rpt. (1938–40) 10: 114.

Both *coryli* and *waldeni* were erroneously listed as synonyms of *vaporariorum* by Baker and Moles, but they, as well as *morrilli*, are believed by the writer to be synonyms of *packardi*. The insects reported by the Kansas station (R. L. Parker) as representing a new species of *Trialeurodes* belong to *packardi* also.

The superficial appearance of some insects described under the four names is very different owing to variation in papillae, caudal setae, and size of the insects. Much the same situation prevails in this species as in *vaporariorum* with respect to the submarginal papillae and size of the body. In *packardi*, however, dorsal papillae usually are absent except in specimens from very pubescent leaves, and the caudal setae are usually short and situated close to the body margin in specimens from smooth leaves. Extremes of development of these variable characters may be found in insects from the upper and lower surface of a single leaf provided the two surfaces differ in pubescence and texture. Specimens from the lower surface of some leaves, such as those of *Cercis*, also show a rather complete range in variation of the structures. Insects described as *coryli* and *waldeni* were from extremely hairy leaves, *morrilli* was from smooth leaves, and *packardi* was from moderately pubescent leaves. The correct name of the segregate as it is here understood is *packardi* since that name was established prior to the others.

In this species insects from the upper surface of leaves have the orifice, operculum, and lingula greatly enlarged, the last being particularly large in proportion to the operculum and orifice.

Characteristic of group. Nearly colorless or pale yellowish, rarely light brownish in center. Mounted insects 0.65–1 mm. long and 0.40–0.60 wide. Dorsal derm slightly sclerotized and sculptured, rather thick; ventral derm membranous and moderately thin.

Approximately 25 (22–28 in specimens examined) marginal crenulations in 100 μ. Submarginal papillae exceedingly variable, totaling 68–104, all or any number well developed, greatly reduced in size, or indicated only by an etched, craterlike area; all in a rather regular row, directed laterally or diagonally, and 12–20 somewhat larger than others, or up to 28 papillae slightly mesad of others usually directed vertically and larger than outer ones; when well developed broadly conical with rather blunt tips, measuring downward from 16 μ long by 20 wide and in these proportions, the majority 8–12 μ long and 10–16 wide, nearly contiguous; outer ones rather close to, or more than the width of a papilla from, body margin. Submarginal disk pores one-fourth to nearly the width of a papilla mesad of papillae. Submarginal setal bases about in line with disk pores.

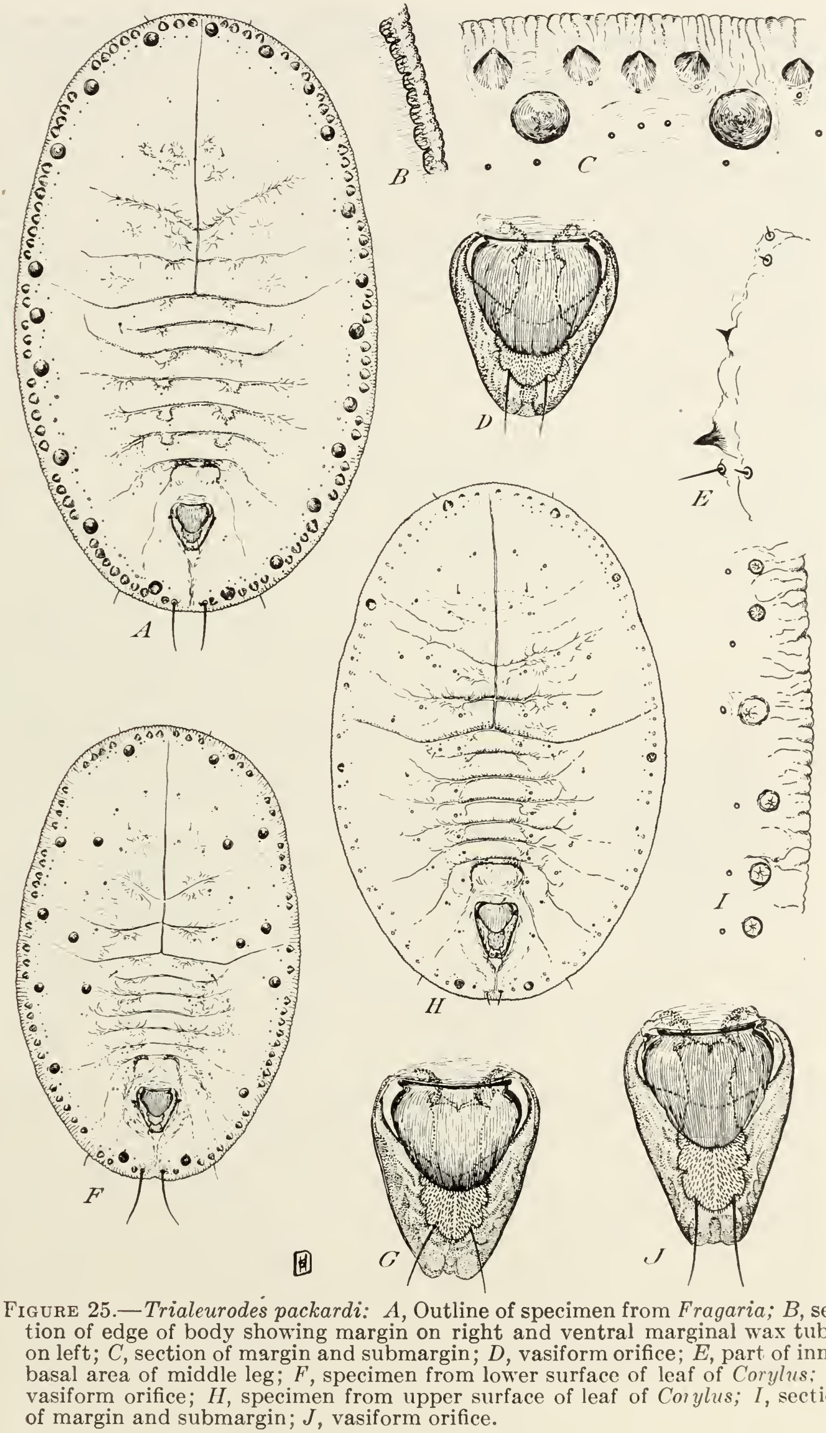

FIGURE 25.—*Trialeurodes packardi:* *A*, Outline of specimen from *Fragaria;* *B*, section of edge of body showing margin on right and ventral marginal wax tubes on left; *C*, section of margin and submargin; *D*, vasiform orifice; *E*, part of inner basal area of middle leg; *F*, specimen from lower surface of leaf of *Corylus;* *G*, vasiform orifice; *H*, specimen from upper surface of leaf of *Corylus;* *I*, section of margin and submargin; *J*, vasiform orifice.

Dorsal disk pores as stated for Pergandei Group, 1 pair of submedian pores on each thoracic segment. Dorsal papillae usually indicated only by a membranous area in derm, but one sometimes developed, particularly near subdorsal pores on specimens from very pubescent leaves, similar in size and shape to submarginal ones. Length of setae approximately as follows: Anterior marginal, 8–10 μ; cephalic, 8–12 μ; first abdominal, 8–12 μ; eighth abdominal, 8–12 μ; caudal, 20–100 μ (usually either around 20, 40 or 80; their bases in line with papillae or distad of them and sometimes at body margin); posterior marginal, 24 μ. Vasiform orifice cordate to elongate cordate, 56–76 μ long and 50–68 wide. Operculum broadly curved posteriorly, 32–48 μ long and 40–56 wide. Lingula 40–52 μ long and 22–28 wide, its long setae reaching beyond edge of orifice. (Largest measurements of orifice, operculum, and lingula in specimens from upper surface of leaves only.)

A readily distinguishable spine and a minute one on each leg, those of middle leg slightly larger than the others and the large one about 6 μ long. Ventral abdominal setae 24 μ long.

HOSTS.—*Ambrosia trifida* L., *Amphicarpaea bracteata* (L.) Fern., *Arctostaphylos uva-ursi* (L.), *Aster lateriflorus* L., *Azalea pontica* L., *Betula* sp., *Bignonia radicans* L., *Callicarpa americana* L., *Callicarpa* sp., *Carpinus* sp., *Catalpa* sp., *Ceanothus americanus* L., *Cercis canadensis* L., *Chionanthus virginica* L., *Collinsonia canadensis* L., *Corylus americana* Walt. (cotypes of *coryli* and other specimens), *C. avellana* L., *Cryptotaenia canadensis* (L.) DC., *Desmodium paniculatum* (L.) DC., *Deutzia* sp., *Fragaria* spp. (type, paratype, and other specimens), *Helianthus tuberosus* L., *Helianthus* sp., *Hibiscus moscheutos* L., *Hypericum* sp., *Impatiens biflora* Walt. (cotypes of *morrilli* and other specimens), *I. pallida* Nutt., *Impatiens* sp., *Juglans cinerea* L. (cotypes of *waldeni* and other specimens), *Lonicera* sp., *Mentha canadensis* L., *M. citrata* Ehrh., *Ostrya* sp., *Philadelphus* sp., *Prunella vulgaris* L., *Prunus persica* (L.) Batsch, *Prunus* sp., *Pyrus malus* L., *Rosa wichuraiana* Crépin, *Rubus nigrobaccus* Bailey (cotypes of *coryli*), *R. odoratus* L., *Rubus* spp., *Saururus* sp., *Solidago* spp., *Spiraea bumalda* Burvenich var. Anthony Waterer, *S. vanhouttei* (Briot) Zabel, *Symphoricarpos* sp., *Ulmus* sp., *Verbena urticifolia* L., *Viburnum acerifolium* L., *V. dilatatum* L., *Viburnum* sp., *Viola* sp.

DISTRIBUTION.—California: Arcadia, Whittier. Colorado: Boulder, Dayton. Connecticut: Mount Carmel and New Canaan (cotypes of *waldeni* from both locations), New Haven, Poquonock, Scotland, Woodbridge (cotypes of *coryli* from each location), West River meadows (New Haven) (cotypes of *morrilli*), Westville. Delaware: Newark. District of Columbia: Rock Creek Park, Takoma Park, Washington. Florida: Lake City. Georgia: Fitzgerald. Illinois: Champaign, Glenview, Urbana. Iowa: Ames. Kansas: Manhattan. Maine: Parkman. Maryland: Garrett Park, Plummers Island, Silver Spring, Weverton. Massachusetts: Amherst (type, paratype, and other specimens). Michigan: Alexander. Minnesota: Iron Springs. Missouri: St. Louis. New Jersey: Bridgeton. New York: Bronx, Crown Point, Long Island, Melrose, Rochester, Staten Island. Oregon: Klamath Falls. Nevada: Fallon. North Carolina: Chadbourn. Ohio: Columbus. Pennsylvania: Chambersburg, Harrisburg, Mount Alto, North East, Springbrook. Rhode Island: Kingston. Texas: Asherton. Virginia: Difficult Run, Falls Church. Washington: Union Gap.

Canada: Locality not given.

Hawaii: Kaneohe.

Redescribed from an abundance of unmounted material and about 900 mounted specimens. Type specimens of *packardi* loaned by C. P. Alexander.

TRIALEURODES FERNALDI (Morrill), new combination

Aleyrodes fernaldi Morrill, 1903, Psyche 10: 83–85, illus.; Britton, 1907, Ent. News 18: 341; Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 100.

Members of this species examined by the writer were from smooth leaves, and the development of papillae and caudal setae was similar to that in many specimens of *packardi* developing on glabrous surfaces. Although the papillae were degenerate and the caudal setae short in all specimens seen, it is possible that a long series of specimens would exhibit variation in these structures, particularly if the insects were from different types of leaves.

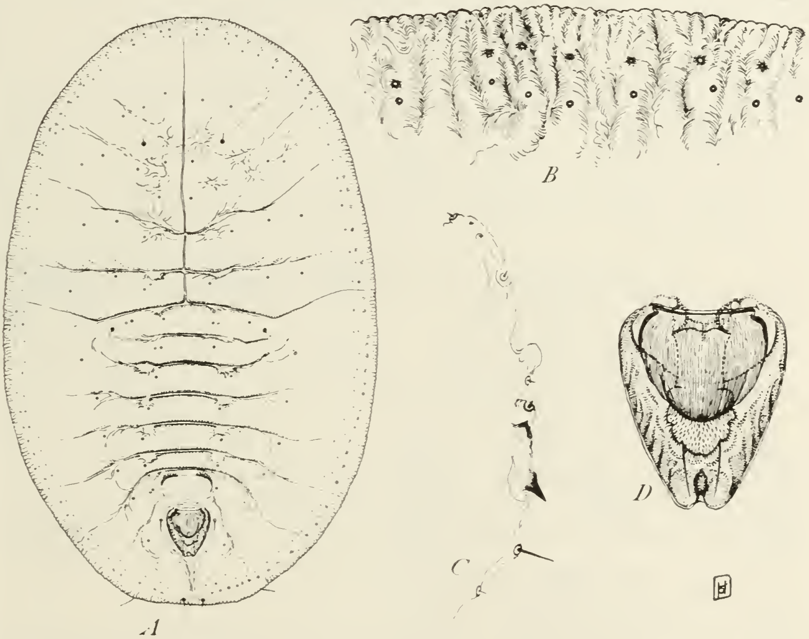

FIGURE 26.—*Trialeurodes fernaldi: A,* Outline; *B,* section of margin and submargin; *C,* part of inner basal area of posterior leg; *D,* vasiform orifice.

Characteristic of group. A little white powdery wax sometimes present in center of body. Pale yellow or nearly colorless, sometimes slightly brownish in subdorsal area. Mounted insects 0.75–1 mm. long and 0.50–0.65 wide. Dorsum slightly sclerotized and sculptured, fairly thin, ventral derm more membranous.

Around 22 marginal crenulations in 100 μ. Submarginal papillae in a single regular row of 85–105, indicated by a lined, circular area, and often situated on a minute prominence, about as far from one another and from body margin as they are from disk pores. Submarginal disk pores two to four times the width of a degenerate papilla from the papillae. Submarginal setal bases about in line with submarginal disk pores.

Dorsal disk pores mostly typical of group, but 2 submedian pairs on prothoracic segment and 1 submedian pair on second abdominal segment. A membranous area often apparent near any pore. Length of setae approximately as follows: Anterior marginal, 6 μ; cephalic, 12 μ; first abdominal, 10 μ; eighth abdominal, 14 μ; caudal, 16–24 μ (bases close to body margin); posterior marginal, 24 μ. Vasiform orifice elongate cordate, 56–68 μ long and 52–56 wide. Operculum 32–46 μ long and 44–50 wide. Lingula 40–44 μ long and 22–24 wide, its long setae reaching to edge of orifice.

A spine about 7 μ long on each middle and posterior leg and a slightly smaller one on anterior leg, also a minute spine on each leg. Ventral abdominal setae 20 μ long.

Hosts.—*Cephalanthus occidentalis* L., *Spiraea vanhouttei* (Briot) Zabel, *Spiraea* sp. (type, paratype, and other specimens).

Distrubution.—Connecticut: Westville. Massachusetts: Amherst (type, paratype, and other specimens), Lynnfield, Malden, and an unstated locality.

Redescribed from a few unmounted and 52 mounted spcimens. Type specimens loaned by C. P. Alexander.

TRIALEURODES RUBORUM (Cockerell)

Aleurodes ruborum Cockerell, 1897, N. Y. Ent. Soc. Jour. 5: 96–97.

Aleyrodes subgenus *Trialeurodes ruborum* (Cockerell), 1902, Acad. Nat. Sci. Phila. Proc. 54: 283.

Asterochiton ruborum (Cockerell), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.

Trialeurodes ruborum (Cockerell), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi.

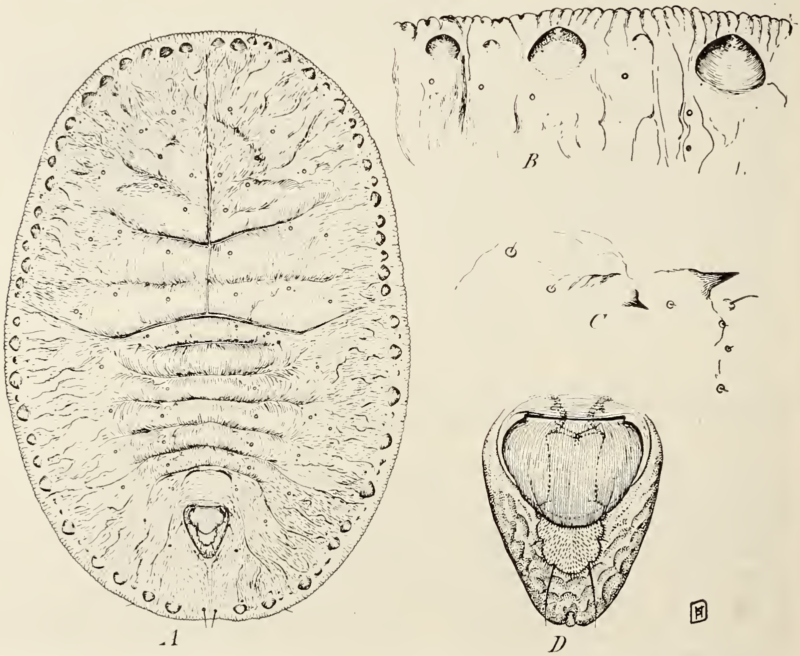

Figure 27.—*Trialeurodes ruborum: A,* Outline; *B,* section of margin and submargin; *C,* part of inner basal area of middle leg; *D,* vasiform orifice.

Many representatives of *ruborum* were present on the upper surface of leaves, in some instances being more numerous there than on the lower surface, and they were found on smooth, moderately hairy, and very hairy leaves. However, neither differences in the location of the insects nor in the physical properties of their hosts appear to be responsible for the variation observed in the submarginal papillae and the caudal setae of the insects. Moreover, there is no appreciable difference in the vasiform orifice, operculum, or lingula in specimens from the two surfaces of a leaf.

Although usually occurring in moderate numbers, *ruborum* is sometimes abundant.

Characteristic of group. Very dark brown or black. Mounted insects 0.75–1 mm. long and 0.50–0.75 wide. Dorsal surface sclerotized, thick, strongly sculptured, ventral surface membranous but rather thick.

Approximately 22 marginal crenulations in 100 μ. Submarginal papillae totaling 60–96, all, or as few as 18, well developed, degenerate ones indicated by a differentiated area in derm; all arranged in a single regular row, or a number of larger papilla slightly mesad of smaller ones, directed laterally, and about the length of an average papilla from body margin; broadly conical, apices curved, largest ones around 16 μ long and 24 wide and ranging downward from this size and in these proportions; when all are well developed around one-third of the total number may be distinctly larger than the remainder. Submarginal disk pores the width of a small papilla from the papillae. Submarginal porettes unusually conspicuous. Submarginal setal bases slightly mesad of disk pores.

Dorsal disk pores arranged as stated for group, 1 submedian pair on each thoracic segment. Membranous areas often present around some porettes. Length of setae approximately as follows: Anterior marginal, 8 μ; cephalic, 8–12 μ; first abdominal, 12 μ; eighth abdominal, 10–12 μ; caudal, 16–56 μ, usually between 16 and 40 μ (their bases in line with or distad of submarginal papillae, sometimes at body margin); posterior marginal, 12 μ. Vasiform orifice elongate cordate, 60–80 μ long and 48–64 wide. Operculum 40–44 μ long and 44–56 wide. Lingula 44–52 μ long and 22–26 wide, its long setae reaching beyond edge of orifice.

A spine 8–10 μ long and one around 6 μ long on each leg. Ventral abdominal setae 16–20 μ long.

HOSTS.—*Fragaria* sp., *Rubus glaucus* Benth., *Rubus* spp. (cotypes and other specimens).

DISTRIBUTION.—District of Columbia. Florida: Brooksville, Lake City (cotypes), and an unstated locality. Louisiana: Buras. Maryland: Garrett Park, Glendale, Silver Spring. Virginia: Vienna.

Redescribed from numerous unmounted and more than 100 mounted specimens.

TRIALEURODES VITTATA (Quaintance)

Aleurodes vittata Quaintance, 1900, U. S. Dept. Agr., Div. Ent., Tech. Ser. 8: 42, illus.

Aleyrodes subgenus *Trialeurodes vittata* (Quaintance), Cockerell, 1902, Acad. Nat. Sci. Phila. Proc. 54: 283.

Asterochiton vittata (Quaintance), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.

Trialeurodes vittata (Quaintance), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi.

Aleyrodes wellmanae Bemis, 1904, U. S. Natl. Mus. Proc. 27: 525–526, illus. (New synonymy.)

Asterochiton wellmanae (Bemis), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.

Trialeurodes wellmanae (Bemis), Quaintance and Baker, 1915, U. S. Dept. Agr Bur. Ent., Tech. Ser. 27: xi.

Aleyrodes glacialis Bemis, 1904, U. S. Natl. Mus. Proc. 27: 518–519, in part.

Asterochiton glacialis (Bemis), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105, in part.
Trialeurodes glacialis (Bemis), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi, in part.
Aleyrodes sp., Quaintance, 1907, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 12: 94.

Study of cotype specimens of *wellmanae* reveals that there is no reason for retaining it as a valid specific name. The "large yellow semitransparent pores" said to be present in some specimens of *wellmanae* are also present in *vittata* though they were not mentioned in the original description of that species. *Trialeurodes vittata* was described from "chapparal" and this plant material was recently identified as *Rhamnus californica*, the plant from which *wellmanae* was described.

The specimens described as *glacialis* which actually belong to *vittata* resemble *glacialis* superficially, but actually are entirely distinct from it.

Trialeurodes vittata exhibits much the same variation in papillae and caudal setae as *packardi*, and in this species also the variation can often be correlated with differences in host leaf structure. The orifice, operculum, and lingula are only slightly larger in specimens from the upper surface of leaves than in those from the lower surface, however. This species varies conspicuously in color, a range from practically colorless to dark brown often being found in specimens from a single leaf. It sometimes occurs abundantly, literally covering the leaves.

Characteristic of group in most respects. Very light brownish (almost colorless), medium brown, very dark brown, or brown with a light median stripe and sometimes light along lateral margins also. Mounted insects 0.75–1 mm. long and 0.50–0.60 wide. Dorsal surface moderately to strongly sclerotized, usually strongly sculptured, ventral surface more membranous but rather thick.

Approximately 23 marginal crenulations in 100 μ. Submarginal papillae well developed, a total of 104–178 arranged in a single or an irregularly double row, majority directed laterally and a few diagonally in specimens from smooth leaves, and majority directed diagonally and some vertically in specimens from very hairy leaves; 6–14 pairs usually somewhat larger than others and pointing laterad if in line with others, or directed upward if mesad of others; largest papillae 16 μ long and 14 wide, smallest about 8 μ long and 6 wide, but majority around 12 μ long and 10 wide; rather roundly conical, apices rather acute; papillae usually nearly contiguous but some as much as the width of one apart in irregular row, about the width of a papilla from body margin. Submarginal disk pores about the width of a papilla mesad of papillae, submarginal porettes unusually large and conspicuous. Submarginal setal bases about in line with submarginal disk pores.

One pair of submedian disk pores on each thoracic segment; in addition to other dorsal disk pores given in group characterization, at least 1 pair on third or fourth abdominal segment, and sometimes 1–8 subdorsal pairs on any segment; additional pairs usually most numerous on cephalothoracic and third and fourth abdominal segments, and often lacking from the posterior 3 or 4 segments. Membranous areas of varying size, or well-developed papillae near any number of dorsal pores; papillae up to 12 μ long and wide, usually numerous on specimens from very hairy leaves, but these and membranous areas present or absent on other specimens. Length of setae approximately as follows: Anterior marginal, 4 μ; cephalic, 12 μ; first abdominal, 6–12 μ; eighth abdominal, 6–8 μ; caudal, 20–60 μ (their bases in line with papillae, distad of them, or sometimes at margin); posterior marginal, 28 μ. Vasiform orifice elongate cordate, 56–68 μ long and 48–56 wide. Operculum broad posteriorly but somewhat pointed at tip, measuring 28–40 μ long and 44–56 wide. Lingula 40–48 μ long and 20–28 wide, its long setae reaching beyond edge of orifice.

Two spines on each leg, larger ones 8–10 μ long, smaller ones around 4 μ long. Ventral abdominal setae 24 μ long.

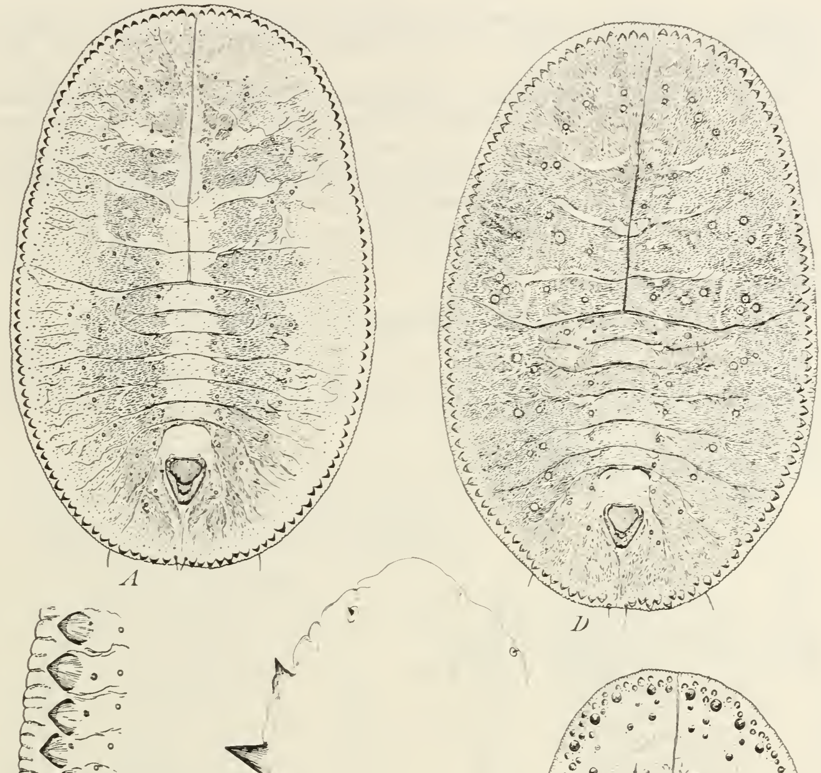

FIGURE 28.—*Trialeurodes vittata:* *A*, Outline of specimen from smooth leaf; *B*, section of margin and submargin; *C*, vasiform orifice; *D*, outline of specimen from smooth leaf, showing greater development of membranous areas and dorsal papillae; *E*, part of inner basal area of middle leg; *F*, male pupa, outline of specimen from very hairy leaf; *G*, section of margin, submargin, and subdorsum.

Hosts.—*Crataegus coccinea* L., *Rhamnus californica* Esch. (cotypes of *glacialis*, *vittata*, *wellmanae*, and other specimens), *Rhamnus* sp., *Vitis vinifera* F., *Vitis* sp.

Distribution.—California: Berkeley, Chico, Chiles, Claremont (cotypes of *vittata*), Marysville, Mendocino, Ontario (cotypes of *vittata*), Pasadena, Pomona (cotypes of *vittata*), Sacramento Valley, Santa Barbara, Santa Cruz (cotype of *glacialis*), Snelling, Stanford University Campus and Stevens Creek (cotypes of *wellmanae* from both locations), and unstated localities.

Redescribed from an abundance of unmounted material and about 400 mounted specimens.

TRIALEURODES HEUCHERAE, new species

Typical of group. Dorsum rather heavily sclerotized, particularly in center, sculptured, ventral derm membranous but rather thick. Very dark brown in center of dorsum but a broad marginal band yellow. Mounted insects 0.80–0.90 mm. long and 0.55–0.65 wide.

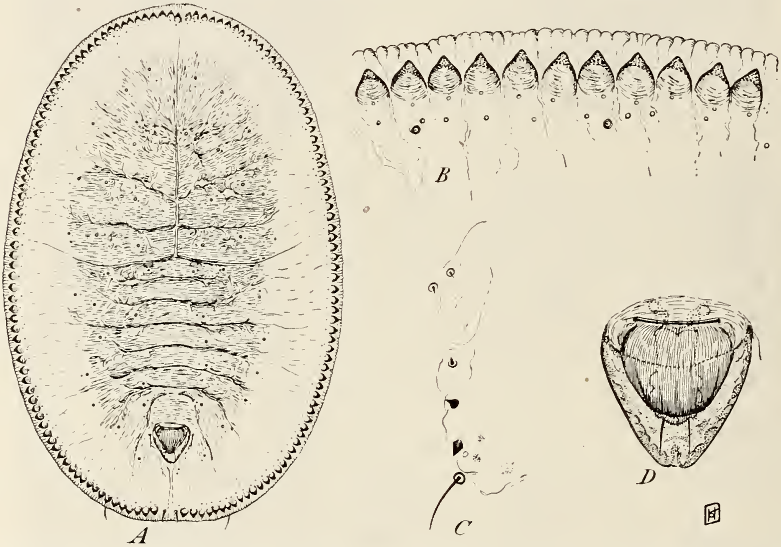

Figure 29.—*Trialeurodes heucherae: A*, Outline; *B*, section of margin and submargin; *C*, part of inner basal area of middle leg; *D*, vasiform orifice.

Approximately 24 marginal crenulations in 100 μ. Submarginal papillae in a single row of 144–160, contiguous at base, conical, the majority 16 μ long and 14 wide but an occasional one as small as 12 μ long and 10 wide or as large as 22 μ long and 18 wide, their apices directed laterally and extending to within half the length of a papilla of body margin. Submarginal disk pores about the width of a papilla from papillae. Submarginal porettes almost as large as pores. Submarginal setal bases in line with disk pores.

Dorsal disk pores arranged as for group, 1 pair of submedian pores on each thoracic segment. Eyespots sometimes faintly indicated in edge of dark area on cephalic segment. Length of setae as follows: Anterior marginal, 4–6 μ; cephalic, 10–12 μ; first abdominal, 10–12 μ; eighth abdominal, 10–12 μ; caudal, 16–24 μ (bases in line with papillae); posterior marginal, 20 μ. Vasiform orifice cordate, its posterior end one and one-half times length of orifice from body margin; orifice 56–60 μ long and 50–52 wide. Operculum 40 μ long and 44–48 wide, covering all or all but terminal lobe of lingula. Lingula 40 μ long and 24 wide, lobes of lingula unusually small, long setae of lingula reaching almost to edge of orifice.

Elongate setae on each middle and posterior leg 12 μ long; apparently 2 spines, each 2–4 μ long, on each leg. Ventral abdominal setae 20 μ long.

Host.—*Heuchera americana* L.

Distribution.—District of Columbia: Rock Creek Park.

Described from several unmounted and 21 mounted specimens collected by J. E. Walter, November 4, 1923, and April 10, 1941 (holotype and paratypes).

Mr. Walter observed adults emerging from the pupae in the spring when the old leaves were dying and the new leaves appearing. The imagoes were then found on the new leaves and presumably deposited eggs at that time.

TRIALEURODES MAGNOLIAE, new species

Characteristic of group. Dorsum dark brown except for a pale-yellow area of varying shape and size along each side of body, rather strongly sclerotized and sculptured; ventral derm colorless, fairly membranous but rather thick. As mounted, 0.85–1 mm. long and 0.55–0.75 wide.

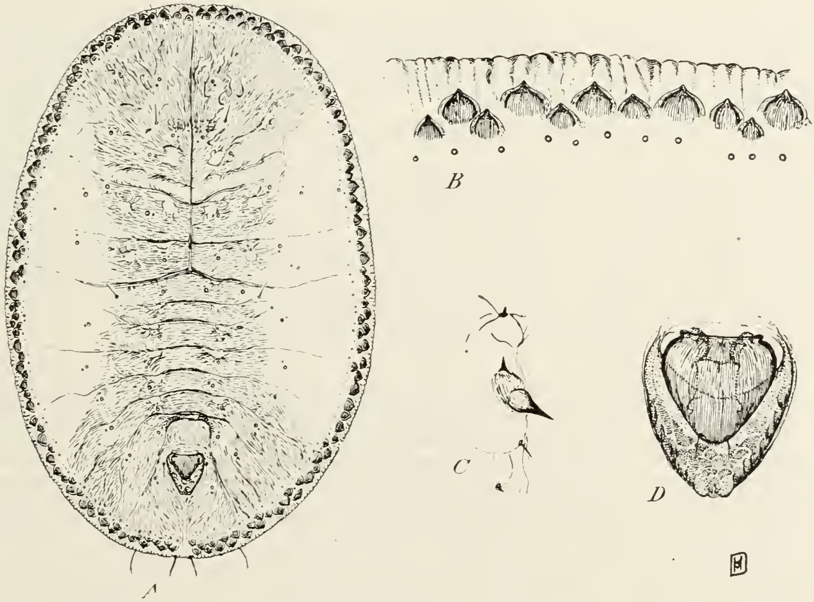

Figure 30.—*Trialeurodes magnoliae*, male pupa: *A*, Outline; *B*, section of margin and submargin; *C*, part of inner basal area of middle leg; *D*, vasiform orifice.

Approximately 20 marginal crenulations in 100μ. Submarginal papillae in a double row of 150–185, those of inner row placed alternately with those of outer row; majority of outer papillae nearly contiguous and rather consistently larger than inner ones which are placed irregularly and are at least half the width of a papilla apart, majority directed laterally but some inner ones pointing diagonally, apices of outer ones about the width of a small papilla from body margin; papillae broad, but outer end narrowed and slightly produced, measuring 10–16 μ long and 12–24 wide. Submarginal disk pores about half the width of a papilla mesad of papillae. Submarginal porettes conspicuous. Submarginal setal bases in line with disk pores.

Dorsal disk pores as in group, 1 submedian pair on each thoracic segment. Porettes often with small membranous areas around them. Length of setae as follows: Anterior marginal, 8 μ; cephalic, 20 μ; first abdominal, 24 μ; eighth abdominal, 16 μ (situated almost opposite widest part of orifice and about halfway between it and nearest suture); caudal, 24–40 μ (their bases rather close to body margin); posterior marginal, 40 μ. Vasiform orifice cordate, its posterior end one and one-third to one and two-thirds times the length of the orifice from body margin, measuring 60–72 μ long and 52–60 wide. Operculum 44–48 μ long and 44–52 wide, rather narrowly curved at posterior end and covering all, or all but terminal lobe of lingula. Lingula 36–48 μ long and 24–28 wide, its long setae not reaching edge of orifice.

A spine 8–12 μ long and one about 4 μ long on each leg and another still smaller one on middle legs. Length of ventral abdominal setae indeterminable in specimens at hand.

HOST.—*Magnolia virginiana* L.

DISTRIBUTION.—Florida: Lake City.

Described from 8 mounted specimens collected by A. L. Quaintance, November 7, 1897 (holotype), and March 15, 1898.

ABUTILONEA GROUP

The Abutilonea Group contains four closely related species, namely, *abutilonea*, *colcordae*, *eriodictyonis*, and *euphorbiae*. *Trialeurodes abutilonea* is distributed from the Atlantic coast to the Pacific and is an important species economically, but the others are known only from the West and apparently are not injurious, though *euphorbiae* is abundant on the leaves at hand. *Trialeurodes abutilonea* occurs on various types of leaves and shows a variation in development of some structures much as has already been observed in *vaporariorum* and *packardi*. The other species, however, are each known from only one type of leaf. Of the group, only *euphorbiae* has been observed by the writer on the upper surface of leaves. This is apparently the most variable group discussed in this publication.

The characteristics of the group are as follows:

Flocculent secretions absent. Dorsal and ventral layers of wax brittle, not adhering closely to body. Derm pale yellow or colorless, occasionally with dark markings, membranous, or faintly sclerotized, fairly thin, usually not sculptured.

Marginal crenulations nearly uniform in width, very narrow, deep, approximately 30 in 100 μ; submarginal ridges moderately well developed, most of them apparent only close to margin; tracheal pore areas usually inevident, but abdominal one rarely indicated by the wideness of 2–6 crenulations. Submarginal papillae somewhat conical, arranged in a single row if distinguishable from dorsal ones, the row interrupted at posterior end of body except in *euphorbiae*. Submarginal disk pores mesad of papillae, usually no more than half the width of a papilla from them. Submarginal porettes at bases of papillae, between papillae and disk pores, very minute and distinct. Submarginal setal bases apparently in 7 pairs on cephalothorax and in 6 pairs on abdomen, situated mesad of disk pores or in line with them, setae usually not distinguishable.

Dorsal porettes very minute, barely distinguishable. Dorsal papillae broadly conical when present, uniformly sclerotized. Transverse molting suture curved slightly posteriorly from center, recurved and reaching submarginal papillae just posterior to a point opposite center of mesometathoracic suture. Seventh abdominal suture as far cephalad as sixth in median area so that only 7 segments are apparent medially, but 8 apparent laterally. Pockets large, no more than half the width of a pocket apart. Anterior marginal setae absent, cephalic, first abdominal, and others present, all slender and tapering; eighth abdominal pair opposite or anterior to widest part of orifice, and as near to orifice as to seventh abdominal suture except in *eriodictyonis*. Vasiform orifice cordate or elongate cordate, its anterior margin usually located three-fourths to nearly full width of orifice from posterior suture; rim not apparent at anterior end but pronounced elsewhere; bottom of orifice rugose, moderately concave. Operculum relatively short and broad or somewhat triangular. Lobes of lingula usually well developed, long setae of lingula reaching to or beyond edge of orifice. Grooves beside orifice and caudal furrow well defined.

Area mesad of legs membranous or only faintly sclerotized, without stout spines or relatively elongate setae. Anterior abdominal spiracles not apparent.

TRIALEURODES ABUTILONEA (Haldeman)

Aleurodes abutilonea Haldeman, 1850, Amer. Jour. Sci. and Arts (ser. 2) 9: 108–109; Quaintance, 1907, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 12: 92; Quaintance, 1908, Homoptera, Fam. Aleyrodidae, *In* Wytsman, Genera Insectorum, fasc. 87, p. 5, illus.

Asterochiton abutiloneus (Haldeman), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.

Trialeurodes abutiloneus (Haldeman), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi.

Aleurodes erigerontis Maskell, 1896, New Zeal. Inst. Trans. and Proc. (n. s. 11, 1895) 28: 429–430, illus. (New synonymy.)

Aleyrodes subgenus *Trialeurodes erigerontis* (Maskell), Cockerell, 1902, Acad. Nat. Sci. Phila. Proc. 54: 283.

Asterochiton erigerontis (Maskell), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.

Trialeurodes erigerontis (Maskell), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi; J. Baker, 1937, [Mex.] Inst. de Biol. An. 8: 620.

Aleurodes rolfsii Quaintance, 1899, Canad. Ent. 31: 90–92, illus. (New Synonymy.)

Asterochiton rolfsii (Quaintance), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.

Trialeurodes rolfsii (Quaintance), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi.

Aleyrodes fitchi Quaintance, 1900, U. S. Dept. Agr., Div. Ent., Tech. Ser. 8: 24–26, illus.

Aleyrodes subgenus *Trialeurodes fitchi* (Quaintance), Cockerell, 1902, Acad. Nat. Sci. Phila. Proc. 54: 283.

Aleyrodes ambrosiae Cockerell, 1910, Canad. Ent. 42: 370–371. (New synonymy.)

Asterochiton ambrosiae (Cockerell), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.

Trialeurodes ambrosiae (Cockerell), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi.

Type specimens of *abutilonea* have not been found in the collections of the Academy of Natural Sciences of Philadelphia, and they are believed to have been lost. There are many specimens available from *Abutilon*, the type host of the species, however, and these are doubtless representative of the species described by Haldeman. Type specimens of *erigerontis*, *rolfsii*, *fitchi*, and *ambrosiae* have been studied by the writer, who believes them to be synonymous with *abutilonea*. *Trialeurodes fitchi* was first synonymized by Quaintance in 1907. Although J. Baker believed *erigerontis* was a synonym of *vaporariorum*, judging from her husband's drawings of its type, it is not closely allied to that species.

As here recognized, *abutilonea* displays conspicuous variation in size, papillae, setae, number of dorsal disk pores, and in the shape of the operculum. As in some other species, the variation can be correlated with the type of leaves on which the insects develop. Specimens developing on hairy leaves tend to be smaller, and to have a greater number of dorsal papillae and longer setae than those maturing on smooth leaves. There is, however, a great deal of variation in and intergradation between these characters. Moreover there are sometimes minor

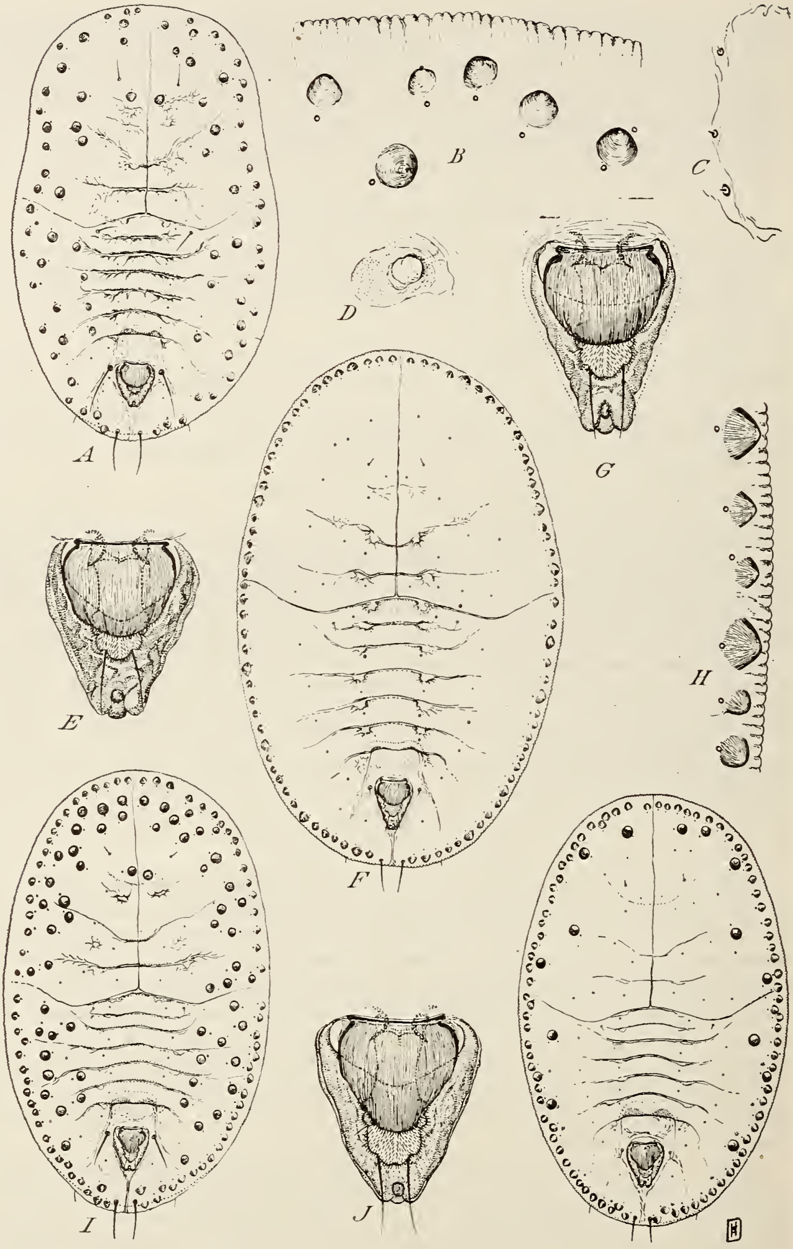

FIGURE 31.—*Trialeurodes abutilonea: A,* Outline of specimen from hairy leaf from eastern United States; *B,* section of margin and submargin; *C,* part of inner basal area of middle leg; *D,* thoracic spiracle; *E,* vasiform orifice; *F,* outline of specimen from smooth leaf from eastern United States; *G,* vasiform orifice; *H,* section of margin; *I,* outline of specimen from very hairy leaf from western United States; *J,* vasiform orifice; *K,* outline of specimen from slightly hairy leaf from western United States.

variations which appear to be tied up with certain hosts. For instance, specimens from *Impatiens* show the poorest development of submarginal papillae observed in this species, a situation which is paralleled in representatives of *packardi* from the same host.

The number of dorsal disk pores may vary slightly in any species, but in those having a somewhat standard pattern of pore arrangement the presence of additional ones is rare indeed. In *abutilonea* several specimens may be found with a standard number of pores. On the other hand, many insects having this number, or additional ones, may be present without a single representative with a smaller number.

The difference in shape of the operculum in *abutilonea* is greater than has been observed in any other species, and in many cases it can be associated with the distribution of the insects. In general, specimens collected east of the Rocky Mountains and central Texas have a relatively short, broad operculum, whereas those west of this area have a more elongate, narrower one. The degree of broadness in eastern and western specimens varies considerably, however, and a few individuals from the East have the operculum similar to those from the West. The significance of the variation in the operculum is uncertain, but it does not appear to be of specific importance. Possibly it is indicative of distributional races. So far as determinable it cannot be correlated with the character of the leaves inhabitated by the insects or with differences in other structures of the insects themselves. In the opinion of the writer, there are not sufficient reasons for recognizing these insects by separate names. Should further investigation of a biological or genetical nature show that they are distinct, however, the eastern segregate would be known as *abutilonea* and the western one as *erigerontis*.

Characteristic of group. Entire dorsum nearly colorless or pale yellowish, or central area or a median stripe brownish. Mounted specimens 0.60–0.90 mm. long and 0.45–0.60 wide, nearly elliptical, posterior margin of body usually turned underneath body. Submarginal papillae in a single irregular row with some distinctly mesad of others and appearing as subdorsal, or in a regular close-set row, 44–112 observed; half the width of a papilla to four times that distance apart, the width of a papilla from body margin, and usually directed diagonally or vertically if in an irregular row; usually nearly contiguous, about half the width of a papilla from body margin, and directed laterally or diagonally if in a regular row; when well developed, broadly conical with apices rather blunt, largest papillae 16 μ long and 24 wide and majority usually 8–12 μ long and 12–20 wide, but sometimes so reduced as to be nearly indistinguishable. Submarginal setal bases slightly mesad of submarginal papillae when the latter are in a regular row, but some mesad of and some in line with papillae when the latter are in an irregular row.

Dorsal disk pores arranged in a single submedian pair on each body segment except second and eighth abdominal; usually in 2 subdorsal pairs on each cephalothoracic segment except prothoracic, and in 1 subdorsal pair on prothoracic segment and on each of abdominal segments 3–8; 1 or 2 additional subdorsal pairs sometimes present on any or all body segments and occasionally as many as 4 additional pairs on any cephalothoracic segment. Dorsal papillae present or absent near any or all subdorsal pores and often near cephalic submedian pores, same shape and size as submarginal ones when present; a small, very membranous area sometimes adjacent to porettes if papillae are absent. Length of setae approximately as follows: Cephalic, 12–40 μ (usually 12–20 or 30–40); first abdominal, 12–40 μ (usually 12–18); eighth abdominal, 12–80 μ (usually 12–20 or 60–80, situated opposite widest part of orifice or anterior to this, sometimes almost opposite anterior margin of orifice); caudal, 32–80 μ (usually 32–40 or 60–80, bases about in line with submarginal papillae); posterior marginal, 16 μ. Vasiform orifice elongate cordate, 48-72 μ long and 44–56 wide; its rim turned cephalad at posterior end and joining a sharp tooth rising vertically at end of orifice; its posterior end three-fourths to nearly full length of orifice from body margin. Operculum broadly to rather narrowly curved posteriorly; 28–44 μ long and 36–48 wide, extending to center of second pair of lobes or to third pair of lobes of lingula. Lingula 36–52 μ long and 20–28 wide, its third pair of lobes rather elongate, particularly so in specimens in which the operculum is rather narrowly curved.

Ventral abdominal setae 35–40 μ long.

Hosts.—*Abutilon theophrasti* Medic., *Acacia melanoxylon* R. Br., *Aeschynomene virginica* L., *Agati grandiflora* Desv., *Albizzia chinensis* Merrill, *Althaea* sp., *Ambrosia artemisiifolia* L. (cotype of *ambrosiae*), *A. trifida* L., *Ambrosia* sp., *Aster sp.*, *Bidens* sp., *Brassica* sp., *Cassia nodosa* Buch.-Ham., *Citrus* sp., *Desmodium paniculatum* (L.) DC., *Dichondra carolinensis* Michx., *Duranta triacantha* Juss., *Erigeron* sp. (cotype of *erigerontis*), *Eucalyptus* sp., *Euphorbia corollata* L., *Euphorbia* sp., *Euphorbia* (*Poinsettia*) sp., *Fuchsia* sp., *Geranium* sp. (cotypes of *rolfsii*), *Gossypium* sp. (cotypes of *fitchi* and other specimens), *Hebe lewisii* (Armst.) Cockayne and Allan, *Hebe* sp., *Helianthus* sp., *Heterotheca grandiflora* Nutt., *Hibiscus moscheutos* L., *H. mutabilis* L., *H. rosa-sinensis* L., *H. syriacus* L., *Impatiens biflora* Walt., *Ipomoea purpurea* (L.) Roth, *Lactuca serriola* L., *Lawsonia inermis* var. *alba* (Lam.) Hassk., *Liquidambar styraciflua* L., *Lycopersicon esculentum* Mill., *Malva* sp., *Medicago* sp., *Melaleuca hypericifolia* Smith, *Mimosa* sp., *Morus* sp., *Oxalis* sp., *Petunia* sp., *Phaseolus* spp., *Polygonum aviculare* L., *Polygonum* (*Persicaria*) sp., *Pueraria* sp., *Punica granatum* L., *Ricinus communis* L., *Rosa* sp., *Ruellia villosa* Pohl, *Rubus* sp., *Schrankia* sp., *Sida spinosa* L., *Solanum arboreum* Dun., *S. carolinense* L., *S. melongena* L., *S. tuberosum* L., *Solanum* sp., *Solidago californica* Nutt., *Sonchus asper* (L.) Hill, *S. oleraceus* L., *Sonchus* sp., *Stachys albens* Gray, *Taraxacum* sp., *Trichostema lanceolatum* Benth., *Trifolium pratense* L., *Trifolium* sp., *Ulmus* sp., *Verbena* sp., *Viola tricolor* L., *Wisteria* sp., *Xanthium canadense* Mill., *X. strumarium* L., *Xanthium* sp.

Distribution.—Arizona: Glendale, Phoenix. California: Arvin, Chico, Devil's Den, El Centro, Huntington Beach, Los Angeles County, Montecito, Oasis, Ontario, Pasadena, Puente Hills, Riverside, Sacramento, Santa Barbara, Whittier. Colorado: Boulder (cotype of *ambrosiae* and other specimens), Fort Collins, Hotchkiss. District of Columbia: Takoma Park, Washington. Florida: Bartow, Brooksville, Chapman Field, Eagle Lake, Lake City, Miami, Orlando, Pensacola, Titusville, Upola (cotypes of *rolfsii*), Winter Park. Georgia: Atlanta, Spalding County. Illinois: Urbana and vicinity. Indiana: Oriole. Kansas: Lawrence, Manhattan, Wichita. Kentucky: Fulton. Louisiana: New Orleans. Maryland: Calvert County, Chesapeake City, Glendale, Goldsboro, North Point, Port Tobacco, Silver Spring, St. Augustine. Mississippi: Harrisville (cotypes of *fitchi*), Mississippi Agricultural College, Oakland, Stoneville. Missouri: Columbia, St. Louis. New Mexico: Fairacres, Mesilla. New York: Staten Island. Pennsylvania: Belle Vernon, West Grove. South Carolina: Batesburg, Florence. Texas: Austin, Brownsville, College Station, Dallas, La Grange, Laredo, Winter Haven. Utah: Brigham, Hurricane, Moab, Provo, Willard. Virginia: Norfolk, Smithfield.

Mexico: Bomoa, State of Sinaloa; Conejos and Lerdo, State of Durango; Escalon, State of Chihuahua (cotype of *erigerontis*).

Cuba: Cerro, Habana, Vedado, Vibora.

Redescribed from abundant unmounted material and about 1,700 mounted specimens.

TRIALEURODES COLCORDAE, new species

Characteristic of group. As mounted, derm nearly colorless except for a brownish submedian to subdorsal band paralleling body margin. Body nearly elliptical, 0.72–0.78 mm. long and 0.50 wide; its posterior margin turned underneath body. Submarginal papillae poorly differentiated from dorsal ones, but outer row, considered as submarginal, numbering around 110; broadly conical, tips fairly acute, 8–12 μ long and wide, directed diagonally or vertically; one or two times the width of a papilla from body margin and same distance apart except for posterior ones, which may be nearly contiguous. Submarginal disk pores no more than half the width of a papilla from submarginal papillae and usually less. Posterior pair of submarginal setal bases in line with, or distad of papillae, others slightly mesad of papillae.

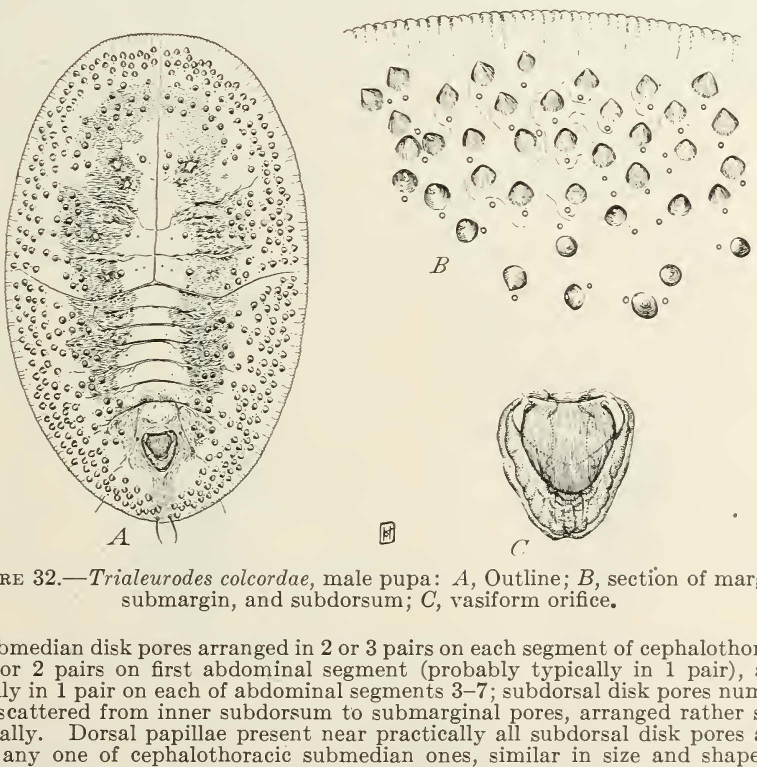

FIGURE 32.—*Trialeurodes colcordae*, male pupa: *A*, Outline; *B*, section of margin, submargin, and subdorsum; *C*, vasiform orifice.

Submedian disk pores arranged in 2 or 3 pairs on each segment of cephalothorax, in 1 or 2 pairs on first abdominal segment (probably typically in 1 pair), and usually in 1 pair on each of abdominal segments 3–7; subdorsal disk pores numerous, scattered from inner subdorsum to submarginal pores, arranged rather segmentally. Dorsal papillae present near practically all subdorsal disk pores and near any one of cephalothoracic submedian ones, similar in size and shape to submarginal ones, directed vertically or diagonally. Submedian depressions shallow, poorly defined, or some unapparent. Lenth of setae approximately as follows: Cephalic, 14 μ; first abdominal, 16 μ; eighth abdominal, 24 μ (bases just anterior to widest part of orifice); caudal, tips broken, 36 μ (bases in line with submarginal papillae); posterior marginal, 24 μ. Vasiform orifice cordate; rim curved posteriorly, not notched or turned cephalad; posterior end of orifice about one and one-third times length of orifice from body margin; orifice 56–60 μ long and 48 wide. Operculum moderately curved posteriorly, 40 μ long and wide, extending to terminal lobe of lingula and covering all of lingula except terminal lobe and tips of posterior lateral lobes. Lingula 40 μ long and 24 wide.

Ventrally a pair of saclike extensions of the body wall slightly posterior to and about the same size as the adhesive sacs. Ventral abdominal setae broken at base in available specimens.

Host.—Unknown (not available).

Distribution.—Southern California.

Described from mounted holotype and one paratype collected in March 1908, no other data. Named in honor of Miss Mabel Colcord.

TRIALEURODES ERIODICTYONIS, new species

These insects are well concealed in the tomentum covering the leaves of their host.

Characteristic of group. Colorless or pale yellow. Body markedly narrowed posteriorly, outline ovoïd. Mounted insect with posterior margin of body turned underneath body; as mounted, around 0.75 mm. long and 0.50 wide. Submarginal papillae in a single irregular row of 64–74, rather conical, their apices acute, measuring 8–12 μ long and wide, majority around the width of a papilla apart but some about half, and some two times that distance apart, around twice the width of a papilla from body margin, majority directed diagonally. Posterior pair of submarginal setal bases in line with, or distad of papillae, others slightly mesad of papillae.

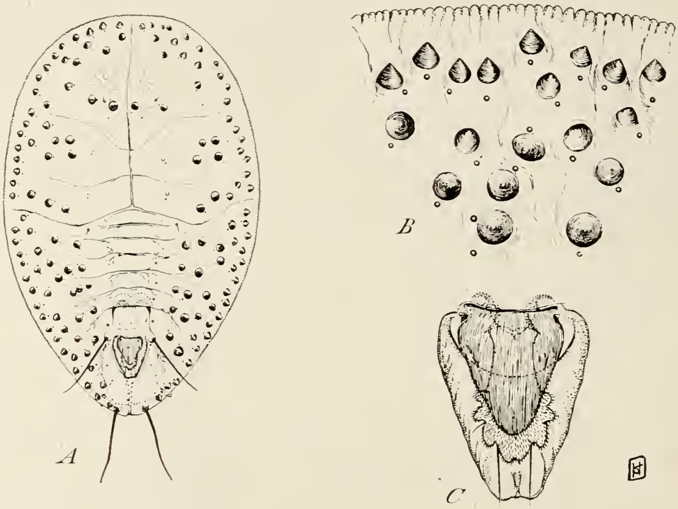

Figure 33.—*Trialeurodes eriodictyonis,* male pupa: *A,* Outline; *B,* section of margin, submargin, and subdorsum; *C,* vasiform orifice.

Submedian disk pores usually in 1 pair on each body segment except second and eighth abdominal; subdorsal disk pores in 2–6 (usually 3 or 4) pairs on each body segment, distributed from subdorsal to submarginal area. Dorsal papillae near practically all subdorsal pores and usually near submedian cephalic pores, same shape and majority same size as submarginal ones, but some inner papillae as much as 16 μ long and wide. Ends of transverse molting suture only slightly anterior to a point opposite its midpoint. Submedian depressions rather poorly defined. Length of setae approximately as follows: Cephalic, 4–6 μ; first abdominal, 4–6 μ; eighth abdominal, 85–125 μ (bases very large, situated on tuberculate areas opposite anterior margin of orifice and bordering posterior suture); caudal, 88–128 μ (bases well mesad of submarginal papillae, actually at margin formed by turning under of posterior edge of body, their bases situated on tuberculate areas also); posterior marginal, 20 μ. Vasiform orifice elongate cordate, situated its length from body margin; its rim turned slightly cephalad and with an indication of a tooth at end of orifice; orifice 60–72 μ long and 44–56 wide. Operculum rather similar in shape to orifice but very narrow posteriorly, 40–52 μ long and 36–44 wide, extending almost or quite to terminal lobe of lingula but not covering lateral lobes of lingula. Lingula 44–50 μ long and 28–32 wide.

Ventrally a pair of saclike extensions of the body wall slightly posterior to and about twice as large as the adhesive sacs. Ventral abdominal setae 48–52 μ long.

Host.—*Eriodictyon crassifolium* Benth.

Distribution.—California: Del Mar (San Diego County), Mount Wilson, San Diego, San Jacinto Mountains, and unstated localities.

Described from a few unmounted and 30 mounted specimens taken as follows: Mount Wilson and an unstated locality (without other data); San Jacinto Mountains, Bridwell and Timberlake, July 14, 1912; Del Mar (holotype and paratypes), P. H. Timberlake, July 26, 1912; an unstated locality, April 28, 1913; San Diego County, April 7, 1920, H. S. Smith.

TRIALEURODES EUPHORBIAE, new species

The leaves harboring *euphorbiae* are small and smooth, and have nearly as many insects on the upper as on the lower surface, but there are no striking differences in structures of specimens from the two positions. Some leaves are literally covered by the insects.

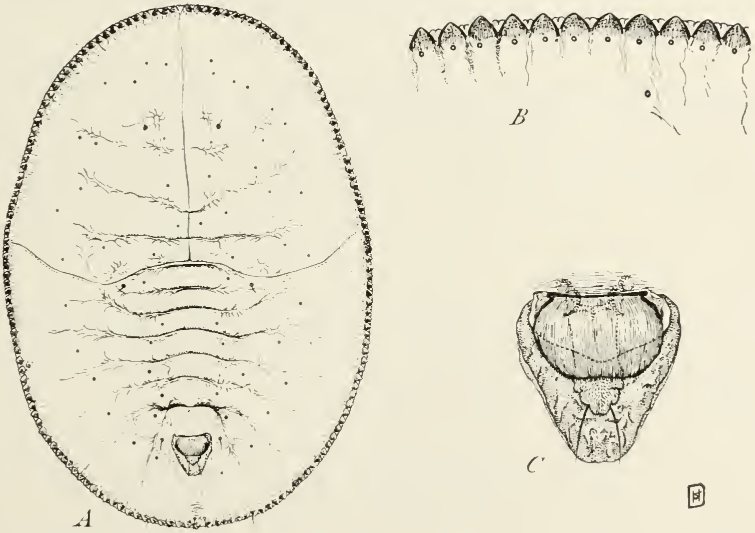

Figure 34.—*Trialeurodes euphorbiae: A,* Outline; *B,* section of margin and submargin; *C,* vasiform orifice.

Characteristic of group. Occurring on both surfaces of leaves. Dorsal derm pale yellow or nearly colorless, or light to medium brown all over or color more intense in median area; ventral derm pale yellowish or colorless. Broadly elliptical, sometimes nearly subcircular, 0.70–0.90 mm. long and 0.50–0.70 wide. Submarginal papillae in a single regular row which is usually unbroken at posterior end of body, totaling 115–176, measuring 8–9 μ long and 12–13 wide, broadly conical, apices rather blunt and in line with body margin or overlapping it, directed laterally, bases of papillae almost or actually contiguous. Submarginal disk pores almost contiguous to bases of papillae. Submarginal porettes practically contiguous to pores. Submarginal setal bases more than the width of a papilla mesad of submarginal disk pores.

Dorsal disk pores usually arranged in 1 submedian pair on each body segment except second and eighth abdominal, and subdorsally in 4 pairs on cephalic segment, in 2 pairs on each thoracic segment, and in 1 pair on each of abdominal segments 3–8 (an additional submedian or subdorsal pore often present on any thoracic segment). Length of setae approximately as follows: Cephalic, 8 μ; first abdominal, 12 μ; eighth abdominal, 12 μ (situated opposite or just anterior to widest part of orifice); caudal, 12 μ (their bases situated anterior to submarginal papillae); posterior marginal, 16–20 μ. Vasiform orifice somewhat cordate but rather broad, particularly at posterior end, 52–64 μ long and 48–60 wide; its anterior end located about two-thirds width of orifice from posterior suture and its posterior end one and one-third times length of orifice from body margin; its rim with or without a small notch at posterior end; sometimes tending to turn cephalad, with or without a broad flat tooth in orifice opposite notch in rim. Operculum usually truncate posteriorly, broadly curved if not truncate, 24–32 μ long and 40–48 wide, extending only to anterior lobes of lingula. Lingula almost spatulate, lobes of lingula poorly developed and distal end of organ nearly as wide as proximal end, measuring 36–40 μ long and 18–20 wide. Caudal furrow usually rather broad and shallow, reaching to caudal setae.

Ventral abdominal setae 16 μ long.

HOST.—*Euphorbia albomarginata* Torr. and Gray.

DISTRIBUTION.—California: Riverside, San Bernardino.

Described from numerous unmounted and 78 mounted specimens collected by A. B. Parish at San Bernardino in October 1903 (holotype and paratypes), and by C. F. Wheeler at Riverside, February 5, 1908.

A SPECIES ERRONEOUSLY ASSIGNED TO TRIALEURODES

ALEYRODES DIASEMUS Bemis

Aleyrodes diasemus Bemis, 1904, U. S. Natl. Mus. Proc. 27: 516–517.

Asterochiton diasemus (Bemis), Quaintance and Baker, 1914, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: 105.

Trialeurodes diasemus (Bemis), Quaintance and Baker, 1915, U. S. Dept. Agr., Bur. Ent., Tech. Ser. 27: xi.

This species belongs in the genus *Aleyrodes* rather than in *Trialeurodes.*

Data accompanying the original description of this species are as follows:

> Collected on campus, Leland Stanford Junior University, along San Francisquito Creek, September 18, 1901, and at various other dates, from the under side of leaves of *Symphoricarpos racemosus.* Also collected on leaves of *Ribes glutinosum,* near Menlo Park, September, 1901, and on the same host in Alameda, June, 1901, and on Kings Mountain, August, 1901.

Material before the writer consists of four slides, each of which is labeled "*A. diasema*" but none of which are marked "type." They are part of the Bemis Collection, however, and may be the only specimens extant which were studied by Bemis. Two slides are labeled "*Symphoricarpos racemosus,* Stevens Creek, 9–18–01," and the other two "*Ribes glutinosum,* Stevens Creek," one dated "9–18–01" and the other "10–20–01." In addition to "*A. diasema,*" one slide from each lot is labeled "*A. glacialis.*" The specimens referred to *glacialis* actually belong to *vaporariorum,* but the others belong to *Aleyrodes.* It is possible that these insects represent cotype material of *diasemus,* and that either the published locality or that printed on the labels is erroneous. If they are not cotype specimens, they doubtless are the most authentic ones available and on them should be based the concept of the species.

SPECIES TREATED AND THEIR SYNONYMS

- *abutilonea* (Haldeman)
  - syn., *ambrosiae* (Cockerell)
  - syn., *erigerontis* (Maskell)
  - syn., *fitchi* (Quaintance)
  - syn., *rolfsii* (Quaintance)
- *bellissima* (Sampson and Drews)
- *bemisae* Russell
- *coccolobae* Russell
- *colcordae* Russell
- *corollis* (Penny)
- *diminutis* (Penny)
- *drewsi* Sampson
- *eriodictyonis* Russell
- *euphorbiae* Russell
- *fernaldi* (Morrill)
- *floridensis* (Quaintance)
- *glacialis* (Bemis)
- *heucherae* Russell
- *hutchingsi* (Bemis)
- *intermedia* Russell
- *madroni* (Bemis)
  - syn., *californiensis* Sampson
- *magnoliae* Russell
- *merlini* (Bemis)
- *mirissimus* Sampson and Drews
- *multipori* Russell
- *notata* Russell
- *oblongifoliae* Russell
- *packardi* (Morrill)
  - syn., *coryli* (Britton)
  - syn., *morrilli* (Britton)
  - syn., *waldeni* (Britton)
- *pergandei* (Quaintance)
- *ruborum* (Cockerell)
- *similis* Russell
- *tentaculatus* (Bemis)
- *tephrosiae* Russell
- *vaporariorum* (Westwood)
  - syn., *lecanioides* (Maskell)
  - syn., *mossopi* Corbett
  - syn., *natalensis* Corbett
  - syn., *nicotianae* (Maskell)
  - syn., *papillifer* (Maskell)
  - syn., *sesbaniae* Corbett
  - syn., *sonchi* (Kotinsky)
- *varia* Quaintance and Baker
- *variabilis* (Quaintance)
  - syn., *caricae* Corbett
- *vitrinellus* Cockerell
- *vittata* (Quaintance)
  - syn., *wellmanae* (Bemis)

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